JPRS-UFM-89-011
22 NOVEMBER 1989

FOREIGN
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JPRS Report

Soviet Union

FOREIGN MILITARY REVIEW

No 7, July 1989

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[The following are translations of selected articles from the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE published in Moscow by the Ministry of Defense. Refer to the table of contents for a listing of any articles not translated.]

FOREIGN MILITARY REVIEW

No 7, July 1989

GENERAL PROBLEMS, ARMED FORCES

The Pentagon: Gambling on Victory in a Nuclear War (Past and Present)

18010885A Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 7-12

[Conclusion of article by Lt Gen I. Perov; first two parts in No 5, 1989, pp 7-13; and in No 6, 1989, pp 7-11]

[Text] The Carter administration came to power in the United States in January 1977. Over the next three years the president issued five special directives concerning U.S. preparation for conducting a nuclear war.

Directive No 18 spelled out requirements for the Pentagon to upgrade the nuclear war plan to give it greater flexibility and multiple options with consideration of present and planned modernization of American strategic offensive arms.

Directive No 53 envisaged further improvement in Armed Forces command and control and communications systems, and above all strategic systems, to ensure stable command and control in conducting a protracted nuclear war.

Directives No 57 and No 58 clarified the procedure for succession to presidential power in an emergency situation and in the course of a nuclear war to ensure "continuity of U.S. government activities." In addition it prescribed further upgrading of antinuclear centers for accommodating members of the U.S. government and government departments and construction of new ones.

Directive No 59 set forth requirements for a new concept of "active opposition" concerning principles of employing U.S. strategic offensive forces to ensure effective nuclear deterrence. As Secretary of Defense H. Brown declared, in having the capability to totally destroy targets on the Soviet Union's territory, the United States must detail a nuclear war plan in accordance with the president's requirements and have the opportunity of multiple-option employment of strategic offensive forces, i.e., it was a question of the capability of delivering not only a massive nuclear strike, but also limited and selected strikes (while at the same time the possibility of the enemy's "guaranteed destruction" must be preserved).

The Pentagon drew up a new plan (SIOP-5D) based on Presidential Directive No 59. The strategic target list already contained up to 40,000 potential nuclear strike targets on the territory of foreign states, including Soviet cities with a population of 250,000 or more; over 3,500 military targets, including some 1,400 strategic missile launch silos and 300 launch control facilities; 500 airfields; 1,200 surface-to-air missile system positions in the Soviet Union's air defense system; headquarters and command posts of Soviet fleets; some 200 Army headquarters and command posts of large strategic formations and large units; over 300 industrial targets, and other targets. A total of at least 4,000 targets on the Soviet Union's territory were listed for nuclear destruction, and of these some 2,000 were specified as first-strike targets.

The numerous targets of nuclear destruction by American strategic offensive forces were consolidated in four basic groups: nuclear forces, general-purpose forces, political and military leadership command posts, and economic and industrial installations.

Specific targets of nuclear destruction were detailed in each of those groups, including:

—Nuclear forces (ICBM and intermediate-range ballistic missile launch silos and launch control facilities, SSBN bases, base airfields for aircraft carrying nuclear weapons, and nuclear weapon depots);

—General-purpose forces (Army, Air Force and Navy garrisons, airfields and bases, ammunition and logistic depots, command posts and other installations);

—Command posts of the country's supreme political and military leadership;

—Economic installations and lines of communication (military industry, heavy machinebuilding, and petroleum refining industry enterprises; electric power stations; rail, water and highway transportation hubs, and so on).

The SIOP-5D plan listed four principal options of U.S. nuclear strikes: massive (against the entire complex of principal political, military and economic installations), selective, limited and regional. They were planned in the form of preemptive strikes and surprise retaliatory counterstrikes.

As in previous U.S. nuclear plans, targets of other Warsaw Pact member states as well as China, Cuba, Vietnam and other countries were listed in addition to targets on the territory of the Soviet Union.

Speaking before Congress in January 1977, U.S. Secretary of Defense D. Rumsfeld declared: "Deterrence must be comprehensive and reliable. . . . The United States presently is increasing nuclear capabilities on a scale that goes far beyond anything required under the theory of minimum or limited deterrence."

The United States began creating highly accurate long-range ground-launched, air-launched and sea-launched nuclear cruise missiles in the mid-1970's. As defined by American Admiral Stephen Hostettler, Tomahawk sea-launched cruise missiles are a new "level" of threat for the Soviet Union, since they can be easily deployed to any point at sea and are capable of delivering a strike

against it from different directions. This weapon can be employed in any stage of a war's escalation. American specialists noted that cruise missiles were the "missing link" between a limited conventional war and nuclear war. Despite the fact that cruise missiles are not a first-strike weapon because of slow flight speed, they are specifically the weapon that will be employed first.

The following are considered to be advantages of cruise missiles:

—Relatively low cost (therefore it is possible to have sufficient numbers of them);

—Long range and high invulnerability when flying at low altitudes (30-300 m);

—Versatility (in nuclear and conventional loading), small dimensions, transportability and sufficient design strength, which permits accommodating them aboard nuclear submarines, surface combatants and aircraft;

—High accuracy.

These are the characteristics of cruise missiles that make them one of the most dangerous modern arms inasmuch as, according to an assessment by the head of the U.S. Navy directorate engaged in planning strategic operations in a theater, they significantly increase the options in selecting a level of escalation without employing the main strategic systems.

The Tomahawk cruise missile with nuclear loading has a 200 KT nuclear charge (16 times greater than the atomic bomb used by the Americans against the Japanese cities of Hiroshima and Nagasaki in World War II). It is difficult for radars to detect. The missile is a little over 6 m long and weighs around 1,360 kg. With the conventional loading this missile is intended for strikes against surface ships at distances up to 550 km from the launch point and against shore targets at distances up to 1,500 km.

In accordance with plans of the American military-political leadership, the naval order of battle is to include up to 200 nuclear submarines and surface combatants that are cruise missile platforms by the mid-1990's. It is planned to produce 4,000 cruise missiles, including some 800 with nuclear loading, to outfit them.

The Pentagon estimates that a group of 4-6 ships carrying such missiles can be comparable in combat capabilities with a U.S. Navy carrier striking force.

Deploying the Minuteman III ICBM with highly accurate multiple nuclear warheads; financing the development of new MX and Midgetman ICBM's, Trident I and Trident II ballistic missiles for SSBN's, and strategic B-1 and B-2 bombers; creating highly accurate long-range nuclear cruise missiles for strategic aviation; and developing other long-range programs were envisaged during modernization and qualitative strengthening of U.S. strategic offensive forces.

Serious emphasis continued to be placed on working out problems of ensuring continuity in the succession to presidential power in a nuclear war.

It is common knowledge that a very specific and clearly defined order is established in this matter under a 1947 U.S. law. In case of the president's death or inability to perform functions as head of government and supreme commander of the country's Armed Forces to the full extent, the successors are (in order of succession) the vice president, speaker of the House of Representatives, president pro tempore of the Senate, secretary of state, secretary of treasury, secretary of defense, attorney general, secretary of interior, secretary of agriculture, secretary of commerce, secretary of labor, secretary of health and human services, secretary of housing and urban development, secretary of transportation, secretary of energy, and secretary of education.

In addition, each new U.S. president issues a special directive on this matter to ensure succession to presidential power in a sudden nuclear war and to grant the right of issuing the order for employing strategic offensive forces. For example, such a succession was specified in the following order in the period of the Reagan presidency: vice president, secretary of defense, deputy secretary of defense, and chairman of the Joint Chiefs of Staff.

Essentially each U.S. president who enters office begins his work by studying above all his rights and duties as supreme commander in questions of employing strategic offensive forces. These functions are practiced periodically in special drills conducted by the JCS and in major strategic exercises. Exercise "Ivy League" (March 1982), which was observed by President Reagan, was the most characteristic in this regard. It practiced the full range of succession to presidential power in connection with the president's "death" and the actions of his successor in command and control of the country and Armed Forces from the JCS airborne command post during a nuclear war.

A special system has been developed for the president's timely evacuation from the White House and his transfer to the airborne command post or to hardened JCS command posts under conditions of a sudden nuclear threat. Special helicopters are kept in constant readiness for departure 7-10 minutes flying time from the White House.

After Carter took office as president, Z. Brzezinski, his assistant for national security affairs, decided to check the real status and readiness of these helicopters for the president's immediate evacuation. He issued instructions for the urgent arrival of one of them to the White House pad, which took 2.5 times longer than specified by standards. In addition, White House security took the approaching helicopter as potentially dangerous and prepared to open fire on it from automatic weapons. In Brzezinski's assessment, such a lengthy period of readiness of presidential helicopters to accomplish their assigned missions did not preclude the "decapitation" of the country's political leadership in case of a real situation.

The Reagan administration came to power in the United States in the early 1980's; it placed chief reliance on force, and above all nuclear force, in its foreign policy course and military organizational development. Secretary of Defense C. Weinberger officially declared that the basis of U.S. military doctrine for the 1980's would be a strategy of "direct confrontation" in relations between the United States and Soviet Union. Its objective was proclaimed as attainment of "total and indisputable U.S. military supremacy," "restoration of America's leadership role in the world," and "active opposition to the Soviet Union in all regions." The Pentagon leadership believed that a powerful U.S. military potential was extremely necessary for preserving a stable and safe world. It was emphasized that diplomacy could be effective only in this case.

The neoglobalist aspirations of American ruling circles with reliance on force became determining. Secretary of Defense F. Carlucci declared that U.S. strategy envisages employing force flexibly and in a sufficient amount so that not one area of "vital interests" is lost because of insufficient efforts. "We must do this and we are doing this," he emphasized.

The following became the principal directions of U.S. military strategy as proclaimed by the Reagan administration: nuclear deterrence; research within the framework of the SDI program; strengthening of forces deployed on forward lines; presence of a powerful strategic reserve; an increase in mobility of Army and Navy forces; unlimited use of sea areas, air space and outer space; effective command and control; and timely, accurate intelligence on the enemy.

It was pointed out that modernization of all components of the American strategic nuclear triad including warning, communications and reconnaissance systems, is the chief factor in neutralizing "negative trends" in the correlation of nuclear forces of the United States and the Soviet Union both at the present time and for the long term.

According to Reagan's assessment, the possibility of U.S. employment of nuclear weapons must remain an important element of the American military strategy. In his opinion, nuclear forces never should be viewed simply as a more advantageous alternative to conventional armed forces. The Armed Forces must be capable of building up the scope and intensity of military operations if necessary in order to end a conflict on conditions favorable to the United States and its allies.

In assessing the American policy of nuclear deterrence, the president emphasized that "it is extremely important that there never be doubt as to the effectiveness of our strategic forces and our resolve to employ them should the need arise." In developing this thought, the Supreme Allied Commander Europe declared that "we must retain for ourselves the opportunity of employing nuclear weapons first. This is an important factor in our deterrence, from which today's containment forms."

The Reagan administration's military-political lines were specifically embodied in a Pentagon directive on defense issues for 1984-1989. It notes in particular that to achieve military supremacy over the USSR the United States must begin "restoring" without delay the military might lost during the Carter administration. To this end the funding requested by the Pentagon, above all for building up strategic nuclear might, was fully satisfied; the program for building the new B-1 strategic bomber cancelled by Carter was renewed; the MX and Midgetman ICBM's were developed at more accelerated rates; and "Ohio"-Class nuclear-powered missile submarines and new Trident II SLBM's for them were built.

Pentagon strategists emphasized that one "Ohio"-Class SSBN armed with 24 Trident II missiles (each with 14 individually targeted nuclear warheads) is capable of sending up 336 nuclear weapons in one launch and delivering precision nuclear strikes against enemy targets located over 8,000 km from the launch point.

There was a substantial increase in capabilities of U.S. strategic offensive forces during the Reagan administration's eight years in power. The majority of B-52 strategic bombers were refitted as platforms for precision long-range cruise missiles. The U.S. Air Force Strategic Air Command received some 100 B-1B strategic bombers. Deployment of new MX ICBM's began. "Ohio"-Class SSBN's with Trident I SLBM's became operational with strategic sea-based nuclear missile forces. The new Midgetman ICBM, the strategic B-2 bomber using Stealth technology, and a new nuclear cruise missile with a range up to 4,400 km for strategic bombers were being created at accelerated rates. The SDI program for developing an ABM defense system with space-based components received a green light in the financing plan.

On the whole, the Reagan administration accelerated the rates of military organizational development, providing a military budget amounting to $1.6 trillion for the five-year period. It was planned to spend these funds for developing and deploying the modern weapons which had been planned by the country's supreme military leadership, as well as for producing 17,000 additional nuclear weapons. The foreign press notes that while three nuclear weapons were made daily in the United States before President Reagan's arrival in power, from five to ten were made daily after that.

According to a statement by Reagan in 1987, even if the United States did succeed in reaching the agreements with the Soviet Union for which it was striving, the United States would continue to need modernized, highly effective and invulnerable nuclear forces to ensure deterrence.

Secretary of Defense Weinberger emphasized that in addition to the capability of fully destroying targets on the territory of the Soviet Union, the United States has options for delivering more limited selective strikes for the planned elimination of the state and military command and control system, nuclear and conventional

armed forces, as well as the economic base necessary for continuing a war. Our plans, he said, must provide a number of options for actions, from the employment of a small number of strategic or operational-tactical nuclear weapons against individual targets to the employment of a considerable portion of our nuclear forces against a broad range of targets, using the entire arsenal of possible nuclear war scenarios.

With respect to American nuclear weapons in Europe, the Pentagon believes they supplement the U.S. strategic offensive forces and are intended exclusively for conducting a so-called "limited" theater nuclear war. Pentagon leaders emphasize that the overall number of nuclear weapons available for use in Europe is very large and it is planned to use them under the following three basic options:

—Limited, for selective destruction of a specific number of fixed military and industrial targets of Warsaw Pact member countries to show resolve;

—Regional, for destroying, for example, the first echelon of enemy forces;

—Theater, including against second echelons and reserves.

"Frankly speaking," admitted former Secretary of Defense Rumsfeld, "the United States set a precedent for deploying theater nuclear forces. The postwar American leadership unquestionably incorrectly estimated the scale of the U.S. nuclear monopoly and the time periods which the Soviet Union would require for creating its own theater nuclear forces.... The scale of threat from Soviet conventional forces oriented toward Europe was overestimated."

The Bush administration arrived in the White House in 1989. Speaking at an American Veterans of War conference in March, the new president declared that "the secret of U.S. success can be defined by the single word strength'." In his opinion, the United States and its allies must understand that even with consideration of the military reductions proposed by the Soviet Union, it continues to be the most formidable military force opposing the free world.

The initiative of Warsaw Pact member states for beginning talks with NATO on reducing tactical nuclear weapons in Europe is meeting with strong opposition from U.S. conservative circles. Secretary of Defense R. Cheney declared in particular: "We must not fall into this dangerous trap.... I see no circumstances in the future under which we will be able to remove all nuclear weapons from Europe. Such a step would undermine the foundations of deterrence, striking a blow against our strategy of flexible response.'... Nuclear modernization is necessary.... Based on this, the Bush administration firmly supports modernization of tactical nuclear weapons in Europe.... If NATO European allies decide to arrange talks with the USSR on reducing operational-tactical missiles, the U.S. administration will consider the possibility of removing American forces from the European continent as a sign of protest."

According to foreign press reports, the Bush administration subsequently intends to realize long-range directions for qualitative development of strategic arms. For example, Secretary of Defense Cheney declared that a decision had been made to deploy the MX ICBM on railroad flatcars and to finance large-scale development for creating mobile Midgetman ICBM's. In his words, the president was deeply confident that the United States should continue to go forward in the SDI area, on which some $16 billion already had been spent.

On the whole, summing up results of the survey on the Pentagon's gamble on winning victory in a nuclear war, it is apropos to quote a statement by well-known American publicist Jack Anderson. After studying a number of documents which became known to him, he notes that despite repeated denials made over a number of years, there is secret information indicating American military plans to deliver a first strike against the Soviet Union. In this regard one should remind the Pentagon strategists and their supporting forces of the words of U.S. President D. Eisenhower: "People aspire to peace so fervently that one day it is better for political figures to give way and grant them this opportunity."

There are such opportunities today based on the USSR's constructive approach to resolving urgent problems of modern times, an approach imbued with responsibility for the fate of the world. The Soviet Union's policy facilitates development of a political dialogue, a deepening of the process of talks on problems of nuclear weapons and conventional arms, and a search for political ways to stop regional conflicts.

GROUND FORCES

Engineer Support to a U.S. Division Offensive with Assault Crossing of a Water Obstacle

18010885B Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 17-20

[Article by Col (Res) Yu. Korolev, candidate of military sciences, docent]

[Text] U.S. Army regulations and manuals emphasize that success in combat will depend largely on the ability of troops to cross water obstacles, with which European territory abounds, and on the degree of effectiveness of engineer support. Here the U.S. Army command proceeds from the assumption that during offensive operations in the Central European theater a division may encounter water obstacles up to 30 m wide every 12 km, up to 100 m wide every 45 km, and over 100 m wide every 120-140 km. Crossing them will require careful planning, good organization, and command and control.

The presence of a sufficient quantity of engineer forces and assets also is considered to be one of the most important conditions for success.

Foreign military specialists believe that water obstacles are the most effective natural barriers for significantly complicating combat operations. The U.S. Army command takes into account that the enemy will strive to create various artificial obstacles in defending on a water obstacle, and that a proper estimate of the effectiveness of these obstacles will be very important for the conduct of battle. Weather conditions, which may have an effect on increasing or decreasing the difficulties in crossing water obstacles, also are taken into account in planning and organizing an assault crossing.

The foreign press emphasizes that the objective of an assault crossing is to support the crossing of combat forces and assets to the opposite side with retention of their combat effectiveness and rate of advance.

An assault crossing of a water obstacle is considered a special form of combat operations and is planned as part of an offensive engagement. The difficulty in conducting it lies in accomplishing measures to deceive the enemy (preparing dummy crossing points, creating groupings of forces and assets on secondary axes and so on) and to ensure concealment (camouflaging the crossing equipment, moving it up to the crossing site at night or under conditions of limited visibility, and laying smoke screens during the troops' displacement). Troops have to make the assault crossing of water obstacles across a broad front in order to maintain their rate of advance and ensure swift crossing of the maximum number of forces. It is believed that the mobility of engineer subunits must be equal to that of their own forces; in the specialists' opinion, this reduces the threat of their detection by enemy reconnaissance assets and their engagement.

An assault crossing of a water obstacle can be carried out hastily or with planned (preliminary) preparation depending on the situation at hand, the nature of enemy operations and the presence of crossing equipment. Preference is given to the first method. It is recommended that the second method be used when there has been an unsuccessful attempt at a hasty crossing of a water obstacle, when advancing directly from a water obstacle, when the obstacle represents a serious barrier, or when the enemy has established a reliable defense on it.

The American military press has announced that engineer support to a division offensive involving an assault crossing of a water obstacle includes a set of measures, the objective of which is to create favorable conditions for executing assigned missions. It includes performing engineer reconnaissance of terrain on the friendly and opposite banks and on the water obstacle itself, preparing and maintaining crossings, preparing staging areas for the assault crossing and routes over which troops move up or execute a maneuver, neutralizing mines, performing camouflage, concealment and deception [CC&D] measures and so on. Its principal objective is to maintain high rates of troop advance.

Western military specialists note that a division usually does not receive reinforcements in a hasty assault crossing of a narrow (and in some cases also a medium) water obstacle, since it is believed that the division has a sufficient quantity of organic assault crossing equipment. If it is operating on the main axis, it is recommended that the division be reinforced with one or two engineer battalions, two or three floating (self-propelled floating) bridge companies, and a company of engineer vehicles from the army corps.

Brigades advancing in the division first echelon can receive eight bridging and four ramp vehicles of the MFAB-F self-propelled bridge train (around 70 m) for an assault crossing of narrow water obstacles and one or two companies of self-propelled floating bridges for crossing medium and wide water obstacles (see color insert [color insert not reproduced]). Each such company can launch a Class 60 bridge 212 m long or two or three such bridges 117 m and 85 m long respectively or assemble six Class 60 ferries and lay 144 m of flexible road surface for crossing marshy terrain sectors near shore.

The foreign press emphasizes that planning of engineer support to a division offensive involving an assault crossing of a water obstacle is the responsibility of the division and brigade engineers. In addition to the commander's concept, the basis for drawing up such a plan is engineer reconnaissance of the enemy and terrain, which must provide the commander with reliable information about the nature of terrain and the water obstacle in the division area of responsibility, the obstacle system, preparation of enemy positions and so on. It is advisable to collect information about the water obstacle several days before approaching it so as to use this period to determine main crossing points that actually exist and probable crossing points. Working with intelligence officers of brigades and engineer battalions, the brigade engineers must begin these measures at once as soon as the need for an assault crossing is determined.

A division hasty assault crossing of a water obstacle consists of a swift movement of troops to the obstacle across a broad front without additional preparation of troops and staging areas. This is done in the case where advancing large and small units have a large quantity of amphibious equipment and the engineer troops have a sufficient number of engineer forces with assault crossing and ferry-bridge equipment. The foreign military press notes that units and subunits are assigned specific sectors (for first echelon brigades and battalions) in advance. Sector size as well as the number of crossing points in a sector are determined by the commander's concept, by the tactical situation, by the presence of intelligence on the nature of terrain and of enemy defensive positions adjoining the water obstacle, and by the nature of the water obstacle. The following are considered to be features of this kind of assault crossing:

swiftness; surprise; minimum drop in the rate of advance; presence of a weakly organized enemy defense; and a minimum concentration of troops.

A hasty assault crossing of a water obstacle usually has the following sequence: reconnaissance; advance of assault subunits; preparation of assault crossing equipment; crossing of the water obstacle by first echelon battalion task forces and seizure of bridgeheads on the opposite bank; assembly of ferry crossings and launching of bridge crossings; preparation of fords; assault crossing of the water obstacle by the division second echelon and reserves and development of the offensive on the opposite bank. The principal engineer support missions here are to negotiate or destroy obstacles, accompany troops to the crossing sector, locate or restore crossings, use and control crossing equipment, lay approach routes, and prepare exits.

American military specialists believe that division engineer battalion engineer companies will cross a water obstacle together with first echelon subunits to which they are attached to accomplish engineer missions on the opposite bank. Responsibility for performing engineer missions on the near bank and maintaining crossing sectors or points is to be transferred to army corps engineer subunits which are operating in support of the advancing division.

An assault crossing of a water obstacle with planned (preliminary) preparation is accomplished in those cases where it is impossible to cross from the move or when an offensive is conducted from the water obstacle. It also can occur when a broad water obstacle is encountered and when there is a reliable enemy defense on one or both banks. This form of an assault crossing is characterized by the presence of time to concentrate requisite forces and assets, clearing of the enemy from the near bank, winning of air supremacy over the crossing sector, organization of air defense in the vicinity of the crossing sector, detailed planning, and centralized command and control. A bridgehead is to be captured and expanded in three phases, with a line assigned for each phase denoting a terrain sector which must be seized. When troops arrive at the first line it is recommended that the crossings be protected against aimed enemy fire, which will permit assembling light and heavy ferries. The second line is occupied to deprive the enemy of an opportunity to conduct ground surveillance of crossing points, which can create favorable conditions for launching bridges. Arrival at the third line must support the unhindered use of all kinds of crossings and the necessary maneuver of troops in the bridgehead.

The primary missions of engineer troops under these conditions are performing engineer reconnaissance, constructing and maintaining the road net, clearing the terrain of mines and obstacles, assembling and maintaining ferries and foot bridges, constructing dummy bridges, and other missions.

Engineer reconnaissance of the river and adjoining terrain sectors as well as reconnaissance of enemy defensive positions usually is assigned to division engineer and reconnaissance subunits, which operate independently or as part of tactical reconnaissance subunits. In the first instance helicopters with special equipment may be used. Special attention has been given lately to underwater reconnaissance using underwater demolition team personnel because of the increased amount of combat equipment in the troops capable of crossing rather deep water obstacles independently.

The division engineer (engineer battalion commander) exercises overall direction over the organization and conduct of engineer reconnaissance.

Preliminary work to prepare and maintain lateral and axial routes is done to support the subunits' assault crossing of the water obstacle. The first lateral route is to be prepared for lateral communication of first echelon battalion concentration areas and crossing equipment concentration areas; the second for connecting assembly areas of units located no further than 5 km from the obstacle; and the third for communication of first echelon division concentration areas. Axial routes include the division supply route, a road in the zone of advance of each first echelon brigade, and battalion routes from the first lateral route to each assault crossing and ferry crossing site. As a rule, the division supply route is brought up to the bridge crossing. Corps engineer troop subunits prepare and maintain the bulk of all routes.

The most complicated CC&D work performed by engineer subunits includes organizing and maintaining dummy crossing points, preparing crossing equipment concentration areas, as well as camouflaging approach routes to the water obstacle. All other CC&D measures (laying smoke screens, creating feint crossings and so on) are done independently by combat arms subunits. Troop concentration areas at the water obstacle can be prepared as basic fortification structures, and sometimes minefields can be emplaced and barbed-wire entanglements set up on some axes. It is recommended that troops be dispersed to the maximum to improve their protection against mass destruction weapons in areas of concentration and crossing points.

The foreign press notes that the locations and nature of crossing sectors are determined by tactical requirements, the combat mission, and the objective of the offensive after crossing the water obstacle. The choice of crossing sectors depends on the presence of access roads, steepness of banks, as well as current velocity. The presence of improvised means or local materials which can be used must be taken into account here.

Assault crossing site, ferry crossing site and bridge crossing site sectors as well as sectors where vehicles ford and cross over the bottom are prepared to support a troop crossing. Their number depends on the tactical situation, the assigned assault crossing rates, as well as the presence of crossing equipment. Thus, based on exercise experience, up to four assault crossing sectors and five ferry crossing sectors are created for each first echelon brigade of an

armored or mechanized division, and an additional two or three bridge crossings for each division for an assault crossing of a water obstacle over 200 m wide. The overall number of crossing sectors for a division can reach 30. To ensure continuity of a troop crossing it is recommended having a reserve of crossing equipment and materials, the bulk of which is located in rear areas. Forward subunits usually cross on amphibious combat vehicles and tanks and other combat equipment cross on ferries and bridges. Ferry crossing sectors usually are placed in operation in the second phase of an assault crossing, immediately after the first trips are made in assault boats. One ferry each is planned to be used on each ferry crossing on narrow and medium-size rivers, and 2-3 ferries each on broad rivers. Preparation of bridge crossing points will depend on the combat situation.

Crossing security and defense are organized by the crossing area commander using forces and assets of engineer subunits, and in some cases using forces and assets assigned by the combined-arms commander.

The time needed for a troop crossing depends chiefly on how well supplied the troops are with crossing equipment, the nature of the water obstacle, and degree of resistance by the defending enemy. American military specialists believe that using a sufficient number of amphibious vehicles and bridge trains in a hasty assault crossing of a water obstacle, a division can cross a water obstacle of medium width in 5-6 hours, and sometimes even in shorter time periods.

Some of the provisions cited above on organizing engineer support to a division offensive involving the crossing of a water obstacle are checked in the course of numerous army exercises conducted both under national plans and within the framework of annual NATO exercises codenamed "Autumn Forge."

U.S. Mechanized Battalion of "Heavy" Units

18010885C Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 20-21

[Article by Col I. Aleksandrov]

[Text] An upgrading of the table of organization structure of all large and small units is one of the directions for realizing the Army-90 program, which provides for modernization of the U.S. Army. The American command places special emphasis here on searching for optimum variants of the organization of "heavy" units (mechanized and armored divisions and brigades) intended chiefly for combat operations in the European theater of war. The foreign military press notes that reorganization of these large and small units, which is concluding at the present time, also considerably affected the mechanized battalion, one of the basic combat subunits in their makeup. It is emphasized that the new organization is common to all Army mechanized battalions (separate battalions as well as those which are part of "heavy" divisions and separate brigades).

Judging from foreign press announcements, the mechanized battalion organizationally consists of a headquarters and six companies (headquarters company, four mechanized companies, and one antitank company).

The **headquarters** (22 persons) is intended for planning and command and control of combat operations, keeping personnel records, and organizing combat and logistic support both for organic subunits and those attached to the battalion. The headquarters has two M2 Bradley infantry fighting vehicles [IFV's] and three M577A1 command and staff vehicles.

The **headquarters company** (319 persons) performs combat and logistic support missions. It includes a headquarters section (six persons, two M577A1 command and staff vehicles) and six platoons: reconnaissance (29 persons, headquarters in two M3 combat reconnaissance vehicles [CRV's] and two reconnaissance sections with two M3 CRV's each), mortar (34 persons, headquarters in two M966 vehicles and two mortar sections, each with an M577A1 command and staff vehicle and three M106A2 106.7-mm self-propelled mortars), signal (12 persons, two M113A1 APC's, headquarters and two sections: radio communications and wire communications), medical (47 persons, headquarters, first aid station and evacuation section, which has eight M113A1 APC's), support (112 persons, 58 vehicles, headquarters in an M577A1 command and staff vehicle and three sections: transportation, fuel, and rations), repair (79 persons, five M113A1 APC's, headquarters and eight sections: administrative, repair, headquarters and headquarters company maintenance, four mechanized company maintenance, and one antitank company maintenance). The headquarters and headquarters company have a total of 341 persons, two M2 Bradley IFV's, six M3 CRV's, six M106A2 106.7-mm self-propelled mortars, 22 M60 7.62-mm light machineguns, 15 M113A1 APC's, and eight M577A1 command and staff vehicles.

The **mechanized company** (116 persons) is the battalion's basic combat unit and consists of a headquarters and three mechanized platoons. The headquarters has 11 persons (including the company command element), an M2 Bradley IFV and an M113A1 APC. The mechanized platoon (35 persons) has a headquarters section (eight persons, M2 Bradley IFV) and three mechanized squads, each of which has nine persons (squad leader, his assistant, the IFV gunner-operator, driver, Dragon ATGM launcher operator, machinegunner, two assault riflemen, and a rocket launcher man), a Dragon ATGM launcher, and an M2 Bradley IFV. In combat the squad can be divided into fire teams. The company has 13 M2 Bradley IFV's, an M113A1 APC, nine Dragon ATGM launchers, nine M60 7.62-mm light machineguns, 18 M249 5.56-mm machineguns, 74 M16A1 automatic rifles, 18 M203 rifle grenade launchers and other armament.

The **antitank company** (65 persons) is the mechanized battalion commander's mobile antitank reserve. It includes a headquarters (three persons and an M113A1 APC) and three antitank platoons, each with 20 persons, a headquarters (four persons, M113A1 APC), and four antitank sections (each with four persons and an M901 TOW self-propelled antitank missile system). The company has 12 antitank systems, four M113A1 APC's, 12 M60 7.62-mm light machineguns and other armament.

Judging from foreign military press announcements, the mechanized battalion has a total of 870 persons, including 45 officers and warrant officers, 54 M2 Bradley IFV's, 6 M3 CRV's, 6 M106A2 106.7-mm self-propelled mortars, 12 M901 TOW self-propelled antitank missile systems, 36 Dragon ATGM launchers, 23 M113A1 APC's, 8 M577A1 command and staff vehicles, 70 M60 7.62-mm light machineguns, 114 vehicles, some 250 radios and other materiel.

According to American specialists' assessments, such an organization of the mechanized battalion increases its combat capabilities and ensures it of great independence on the battlefield. It is noted that an increase in the number of mechanized companies in the mechanized battalion to four (previously there had been three) will allow the commander to attack two objectives simultaneously and not one, as was previously the case.

In the **offensive** the mechanized battalion usually operates as part of a division's brigade in the first or second echelon (or reserve) on the main or secondary axis. In some cases the battalion can perform a combat mission independently. In combat it is planned to establish battalion task forces on its basis consisting of 2-3 mechanized companies, 1-2 tank companies, and reconnaissance, AAA, engineer and other combat support subunits. According to foreign press announcements, the mechanized battalion can advance with a frontage of 2-3.5 km, and in some cases even up to 5 km (by increasing the intervals between companies). The battalion is assigned immediate and subsequent missions (or objectives), which can be 3-4 and 6-8 km respectively from the forward edge of the battle area.

In the **defense** the mechanized battalion operates as part of the brigade in its first or second echelon (or reserve). It also can perform an independent mission, acting as general security at a distance of 8-10 km from the FEBA or as part of a covering force sent out to a distance of up to 25 km or more from the FEBA. The mechanized battalion can be reinforced by tank, artillery and engineer subunits for organizing a defense. The American military press notes that the battalion is assigned a defense area which can reach 5 km in width and 3 km in depth.

Combat Reconnaissance Vehicles

18010885D Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 22-30

[Article by Col Ye. Viktorov]

[Text] Armies of capitalist countries are devoting considerable attention to questions of tactical reconnaissance. In order to increase its effectiveness, especially under present conditions of combat operations, along with improving the table of organization structures of reconnaissance subunits, measures are being taken to outfit them with the latest models of weapons and combat equipment as well as with appropriate reconnaissance gear.

Tanks, APC's and armored vehicles as well as especially created combat reconnaissance vehicles [CRV's] are used in armies to conduct reconnaissance. CRV's are being developed on tracked or wheeled bases and must possess high speed, good off-road capability, an amphibious capability, air transportability, long range, protection against enemy weapons, and low noise. They are outfitted with necessary reconnaissance equipment permitting performance of assigned missions both day and night.

With some exceptions, CRV's are armed with small-caliber automatic guns and machineguns. There are multi-barrel grenade launchers to lay smoke screens. Ground surveillance radars, radiation and chemical reconnaissance instruments, navigation gear, as well as detectors which signal when they are irradiated by infrared, laser or radar equipment are installed on some vehicles.

The foreign press notes that wheeled CRV's are most widespread in Western European countries, which is explained above all by their advantages over tracked vehicles such as high technical reliability, long operating life, high speeds and considerable range. In addition, assemblies and machine units of civilian vehicles often are used in the construction of wheeled CRV's, which makes their production cheaper and simplifies repair and maintenance. At the present time foreign specialists are working to upgrade these vehicles, and especially to reinforce them with armor protection, install more powerful armament, and improve mobility over rugged terrain. Attention is drawn to using reliable suspensions and equipping wheels with bulletproof tires.

Specifications and performance characteristics of CRV's of capitalist countries are given in the table.

Specifications and Performance Characteristics of CRV's of Capitalist Countries

Model Designation, Year Operational	Combat Weight, tons/Crew	Dimensions, m: Height/Length[1] x Width	Weapon Caliber, mm: Gun/Machineguns	Engine Output, hp	Maximum Speed, kph/Range, km
			United States		
M551 Sheridan light reconnaissance tank, 1966	15/4	2.9/6.3x2.8	152[2]/7.62; 12.7	300	70/500
M3 Tracked CRV, 1981	22.3/5	2.9/6.4x3.2	25[3]/7.62	500	66/480
			Great Britain		
Ferret Mk 2 armored vehicle, 1954	4.4/2	2/3.8x1.9	-/7.62	129	93/300
Saladin armored vehicle, 1956	11.6/3	2.4/4.9x2.5	76/7.62 (two)	160	72/400
Scorpion light reconnaissance tank, 1973	8/3	2.1/4.8x2.2	76/7.62	195	80/640
Scimitar tracked CRV, 1975	7.7/3	2.1/4.8x2.2	30/7.62	195	80/640
Fox wheeled (4x4) CRV, 1973	6.4/3	2/4.24x2.13	30/7.62	195	104/440
			FRG		
Luchs wheeled (6x6) CRV, 1973	19.5/4	2.84/7.74x2.98	20/7.62	390	90/800
Wiesel light tracked combat vehicle, experimental	2.75/2	1.9/3.26x1.8	20[4]/-	86	80/200
			France		
Panhard EBR armored vehicle, 1955	12.8/4	2.2/5.56x2.4	75/7.5 (three)	200	100/700
Panhard AML-90 armored vehicle, 1968	5.5/3	2.1/3.7x1.97	90/7.62	90	90/600
AMX-10RC wheeled (6x6) CRV, 1978	15/4	2.2/6.3x2.8	105/7.62	280	85/800
Sagaie ERC-90 F-4 wheeled (6x6) CRV, 1980	8.1/3	2.24/5.1x2.49	90/7.62 (two)	140	100/800
M11 light armored vehicle, 1985	2.35/2-3	2.1/3.7x2	-[5]/7.62	95	99/530
			Italy		
Type 6616 wheeled (4x4) CRV, 1973	8/3	2/5.37x2.5	20/7.62	160	100/700
R3 light wheeled (4x4) armored vehicle, experimental	3.2/4-5	1.55/4.86x1.78	20/-	95	120/500
			Spain		
VEC wheeled (6x6) CRV, 1982	13.75/5	2.7/6.25x2.5	25/7.62	310	106/800
			Israel		
RBY Mk 1 light wheeled (4x4) CRV, 1971	3.6/8	1.6/5x2	-/7.62 and 12.7 (total of up to five)	120	100/400
			Japan		
87 wheeled (6x6) CRV, 1987	14/5	2.42/5.37x2.48	25/7.62	300	100/500
			Brazil		
EE-9 Cascavel armored vehicle, 1973	12/3	2.6/5.2x2.6	90/7.62 (two)	190	100/880
EE-3 Jararaca wheeled (4x4) CRV, 1980	5.8/3	156/4.1x2.2	-/12.7	120	90/750

1. Hull length is given.
2. Unit of fire includes 10 Shillelagh antitank guided missiles and 20 HE-fragmentation rounds.
3. In addition to a gun there is a TOW antitank guided missile launcher (unit of fire seven missiles).
4. Over 200 vehicles will be armed with the TOW ATGM system.
5. Some of the vehicles will be armed with the Milan ATGM system.

The M41 light tanks and M114 tracked APC's used in reconnaissance subunits of the **United States** Army in the 1960's were later replaced by M113 APC's and M551 Sheridan light reconnaissance tanks (Fig. 1 [figure not reproduced]). In the late 1970's it was decided to remove the latter from the inventory and use M60A1 tanks in their place to perform reconnaissance missions. The new M3 CRV has been entering the American Army since the beginning of the 1980's. It is planned to deliver a total of 3,300.

Some of the M551 Sheridan light reconnaissance tanks (1,700 were produced) still are in the inventory of U.S. Army reconnaissance subunits. This vehicle is characterized by the presence of a gun-launcher allowing it to fire both conventional artillery rounds and the Shillelagh ATGM. The tank hull is made of aluminum alloy and the turret is steel. The experience of this tank's combat use in the Vietnamese war showed the insufficient reliability of some of its assemblies and machine units as well as of the combination armament.

Judging from western press reports, the M3 CRV is becoming the basic reconnaissance vehicle in the U.S. Army, although M60A1 tanks still are being used along with it and M1 Abrams tanks also are in the inventory of reconnaissance battalions of armored cavalry regiments.

The design of the M3 CRV (Fig. 2 figure not reproduced]) is identical to that of the M2 Bradley IFV. The configuration of the assault compartment, which accommodates two observers, battle stowage for ten TOW ATGM's, a motorcycle, AN/PPS-15 ground surveillance radar and other equipment, has been changed somewhat. In addition, the CRV lacks ports along the sides of the rear portion of the hull and additional bottom armor.

The two-place armored turret mounts an M242 25-mm automatic gun, with which a 7.62-mm machinegun is coaxial (unit of fire 1,500 shells and 4,540 cartridges). The armament is stabilized in two laying planes, which permits conducting aimed fire on the move. The gunner has a combination (day and night) sight with an optical attachment for the commander. A TOW ATGM launcher is mounted on the left side of the turret (twin launcher with missiles). In the mid-1980's the launcher was modernized to allow firing TOW 2 missiles.

A VTA-903T eight-cylinder diesel engine with turbosupercharging and HMPT-500 hydromechanical transmission are used in the M3 CRV. They are made in a single block and installed in the right front part of the hull. The driving compartment is located on the left. The running gear has torsion-bar suspension with hydraulic shock absorbers on the first, second, third and sixth road wheels. The tracks have removable rubber pads. The vehicle can cross water obstacles afloat at a speed of 7.2 km/hr by churning the tracks.

The M3 CRV is equipped with night vision devices, AN/VRC-12 and AN/PRC-77 radios, an air filtration and ventilation system and an automatic firefighting equipment system. A modernized model, the M3A1, was tested in 1981. Along with certain improvements, it had reinforced hull and turret armoring.

In the beginning of the 1960's the American firm of Cadillac Gage produced over 4,000 Commando wheeled (4x4) armored vehicles (V-100, -150 and -200 versions), which were exported to more than 20 countries. They can be used for tactical reconnaissance missions. Various machinegun and gun armament is installed on the vehicles. The Commando Scout armored vehicle created by the firm on an initiative basis was purchased by Indonesia. The latest development is the vehicle's V-600 version, on which a Stingray light tank armored turret with 105-mm gun is installed.

For reconnaissance U.S. infantry divisions and the Rapid Deployment Force also can use the M998 Hummer multipurpose vehicle with improved off-road capability, which has been entering service with the troops since 1985.

In **Great Britain** reconnaissance subunits have some 500 obsolete Ferret and Saladin armored vehicles (a small number of the latter remain), 270 Scorpion light tanks, 290 Scimitar tracked CRV's and 200 Fox CRV's.

The Saladin (6x6) armored vehicle was produced from 1958 through 1972. A total of more than 1,170 vehicles were produced which entered service with armies of 18 countries. The bulk of these armored vehicles in the British Army was replaced by Scorpion light reconnaissance tanks produced by the British firm of Alvis.

Armor of the hull and turret of the Scorpion light reconnaissance tank (Fig. 3 [figure not reproduced]) is made of aluminum alloy. The engine-transmission compartment is located in the right front part of the hull. A 76-mm gun with coaxial 7.62-mm machinegun is installed in the turret. The gun's unit of fire basically includes 40 HE-armor piercing projectiles with plastic explosives. The tank is equipped with necessary observation and aiming devices. A light-gathering and amplifying passive night vision sight serves for night firing.

A six-cylinder carburetor engine is used as the power plant. The running gear has torsion-bar suspension, with hydraulic shock absorbers on front and rear road wheels. This tank negotiates water obstacles using individual flotation gear fastened around the perimeter of the hull. An air filtration and ventilation system is used to protect the crew during operations on contaminated terrain.

An entire family of armored vehicles has been created on the basis of the Scorpion light reconnaissance tank, including the Scimitar CRV, which differs from the base version by the presence of a new two-place armored turret with a 30-mm Rarden automatic gun (unit of fire 165 rounds).

The Fox wheeled (4x4) CRV (Fig. 4 [figure not reproduced]) began to enter service with British Army reconnaissance subunits in 1975. It was created by the firm of Daimler on the basis of the Ferret armored vehicle which Daimler previously produced. The hull and turret (the very same as

on the Scimitar CRV) are made of aluminum alloy, which protects against small arms fire. The driver is accommodated in the front part of the hull, with the commander and gunner in the turret. They have necessary devices for observation and fire, including at night. The unit of fire of the 30-mm Rarden automatic gun and coaxial 7.62-mm machinegun is 99 shells and 2,600 cartridges respectively. Smoke grenade launchers are mounted on the turret and there is a light-gathering and amplifying passive night vision sight to the right of the gun.

The Fox CRV uses a six-cylinder Jaguar XK 195 hp carburetor engine. The gearbox provides five gears forward and five in reverse. The wheel suspension is independent coil spring with hydraulic shock absorbers. The vehicle can cross water obstacles up to one meter deep without preparation, and deeper obstacles using flotation equipment (pneumatic floats fastened around the perimeter of the hull). The vehicle is equipped with two radios. A navigation system, ZB 298 moving ground target surveillance radar, as well as radiation and chemical reconnaissance instruments can be installed.

In the early 1980's a modernized version of the Fox called the Panga was created at the state tank construction plant in the city of Leeds where the Fox CRV was produced. This vehicle, with a new single-place turret with 12.7-mm machinegun, was intended for sale to other countries. The experimental model was tested in Malaysia.

In 1984 an experimental model of the Ferret-80 wheeled (4x4) armored vehicle was presented by Alvis at an exhibition of new armament for the British Army. In contrast to previous models of this vehicle, its hull is welded from sheets of aluminum armor (in place of steel). A single-place turret with two machineguns is installed in the mid-section and a 156 hp diesel engine in the rear. The reconnaissance version of the Ferret-80 armored vehicle has a crew of three.

The **FRG** Army has over 400 Luchs wheeled (8x8) CRV's in service (Fig. 5 [figure not reproduced]). This vehicle replaced the American M41 light tanks and the SP1A (SPz 11-2) tracked APC's previously used for tactical reconnaissance missions in reconnaissance subunits.

A typical feature of the Luchs CRV created by the firm of Thyssen-Henschel is the capability of moving forward and backward at the same high speed of 90 km/hr. The front and rear sections of the enclosed armored hull have appropriate controls for this purpose. The power plant is behind the turret to the right. The diesel engine is made in a single block with the hydromechanical transmission. The engine-transmission compartment is well insulated. Sound-absorbing bulkheads are used in this CRV, and because of this a moving vehicle is almost inaudible at a distance of 50 m.

The running gear has a bogie suspension with coil springs and hydraulic shock absorbers. All wheels are driving and controllable. There is a centralized system for pumping air into tires which in particular permits adjusting their pressure depending on road conditions. The Luchs is amphibious, with movement and control on the water provided by two propellers located in recesses in the rear section of the hull. Speed afloat is 10 km/hr.

A 20-mm automatic gun (unit of fire 375 rounds) is installed in the two-place armored turret made by the firm of Rheinmetall. Four-barrel smoke grenade launchers are mounted along the sides, and a 7.62-mm machinegun is on a ring mount above the commander's hatch. Gun-laying and turret-rotating drives are electrohydraulic. The commander and gunner have periscopic sights, which are replaced by thermal-imaging sights for night firing.

The Luchs CRV has an air filtration and ventilation system and an automatic firefighting equipment system (in the engine-transmission compartment). It is equipped with navigation gear and two radios.

The FRG Army has some 140 radiation and chemical reconnaissance vehicles created on the basis of the Fuchs TPz-1 wheeled (6x6) APC and outfitted with special equipment and appropriate gear. Without leaving the vehicle the crew can determine terrain radiation levels, analyze outside air, as well as fire sign markers into the ground using pyrotechnic cartridges. This vehicle also has been accepted for service with the U.S. Army.

The foreign press notes that the Wiesel light tracked combat vehicle created for the airborne troops by the firm of Porsche can be used to conduct tactical reconnaissance. The Bundeswehr command plans to purchase over 340 of such vehicles, of which 210 will be armed with the TOW ATGM system and the others with a 20-mm automatic gun.

The Kondor amphibious wheeled (4x4) APC, produced by Thyssen-Henschel and already supplied to a number of countries, also can be used as a light CRV.

Judging from foreign press announcements, the West German firm of Krauss-Maffei, which produced experimental models of the Puma multipurpose tracked armored vehicle, intends to use it as a base to create a family of combat vehicles for various purposes, including CRV's.

The AMX-10RC wheeled (6x6) CRV (see color insert [color insert not reproduced]) began to be received by **French** Army reconnaissance units and subunits in the late 1970's. It replaced the obsolete Panhard EBR armored reconnaissance vehicles. More than 280 have been supplied. The troops still have some 640 Panhard AML-90 and AML-60 armored vehicles armed with a 90-mm gun and 60-mm mortar respectively. In 1984 the first lot of series-produced ERC-90 F4 Sagaie wheeled (6x6) CRV's was delivered to reconnaissance subunits of the French Force Action Rapide (176 were ordered). The new M11 light armored vehicle also can be used as a reconnaissance vehicle.

The Panhard EBR armored reconnaissance vehicle was produced beginning in the early 1950's. The oscillating turret of the AMX-13 light tank with 75-mm gun was installed in the majority of models. Like the West German Luchs CRV, it can move at the same speed forward and backward (there are two driving compartments in the hull). The 12-cylinder horizontally opposed air-cooled carburetor engine is beneath the fighting compartment floor. All eight wheels are driving and have individual suspension. Two pairs of middle wheels elevate when moving over good roads.

The first Panhard AML armored vehicles entered service with the French Army in 1961. Some 4,500 were produced, the bulk of which were purchased by more than 30 countries. Almost 1,400 such vehicles were produced under license in the Republic of South Africa.

Foreign specialists believe that the AMX-10RC amphibious wheeled CRV is one of the most advanced vehicles of this class. It was created using a number of assemblies and machine units of the AMX-10P IFV. The presence of powerful armament is typical of it. The unit of fire of the 105-mm smoothbore gun includes 38 shaped-charge and HE-fragmentation rounds. It is also proposed to include fin-stabilized armor-piercing discarding sabot projectiles in the unit of fire.

The vehicle hull and turret are welded from aluminum armor sheets. It is equipped with an air filtration and ventilation system. The fire control system has a laser rangefinder and electronic ballistic computer. Passive night vision devices are used for operating during hours of darkness. Smoke grenade launchers are mounted along the sides of the rear of the turret. There is a radio.

The AMX-10RC CRV has high mobility over rugged terrain, and the presence of water jets permits it to cross water obstacles on the move without preliminary preparation. A hydropneumatic suspension allows changing clearance depending on road conditions. The last lots of series-produced vehicles came out with a new 300 hp diesel engine which possibly will replace diesels presently in use.

The other French CRV, the ERC-90 F4 Sagaie, is also amphibious and wheeled (Fig. 6 [figure not reproduced]) and weighs almost half of what the AMX-10RC weighs. It is adapted to be dropped by parachute. The hull and turret, welded from steel armor plates, protect against small arms fire and fragments of artillery projectiles and mines.

A long-barrel 90-mm gun with coaxial 7.62-mm machinegun is installed in the two-place armored turret. The unit of fire is 20 rounds and 2,000 cartridges. The fire control system includes a laser rangefinder and the vehicle is fitted with night vision devices. It can accommodate navigation gear and an air filtration and ventilation system.

The ERC-90 F4 Sagaie uses a carburetor engine. The wheel suspension is independent coil spring with hydraulic shock absorbers. A modernized model of the vehicle in which two diesel engines with an overall output of 198 hp were installed was demonstrated in the mid-1980's. The gun's unit of fire was increased to 33 rounds and a more advanced fire control system was used.

CRV's of the ERC series (with other turrets) were supplied to Argentina, Gabon, Mexico and Chad.

The M11 light armored vehicle intended for reconnaissance or as a platform for the Milan ATGM system was accepted for service with the French Army in 1985. Some 1,000 of the 3,000 armored vehicles planned for purchase will be armed with this system, and the others will have a 7.62-mm machinegun. The M11 is distinguished by good mobility over rugged terrain, and it is amphibious and air transportable.

French firms also created a number of other armored vehicles (primarily wheeled) on an initiative basis which are being offered for sale to other countries for subsequent use as CRV's.

The firms of Fiat and OTO Melara in **Italy** jointly developed the Type 6616 amphibious wheeled (4x4) CRV (Fig. 7 [figure not reproduced]) in the early 1970's. A two-place armored turret is installed in the mid-section of the enclosed armored hull, and the engine-transmission compartment is accommodated in the rear section. The vehicle is armed with a 20-mm automatic gun and coaxial 7.62-mm machinegun. The unit of fire is 400 rounds and 1,000 cartridges. Some of the CRV's produced had a 40-mm rocket launcher mounted on the turret roof plate between the commander's and gunner's hatches.

Several years ago OTO Melara fabricated two experimental models of a two-place armored turret with 90-mm gun and coaxial 7.62-mm machinegun on an initiative basis. Although it was installed on this Italian CRV, it also can be used on other wheeled or tracked vehicles.

The above firm also created the R3 light wheeled (4x4) amphibious armored vehicle in the early 1980's which can be used for tactical reconnaissance. It is armed with a 20-mm automatic gun.

A wheeled (6x6) CRV designated the VEC (Fig. 8 [figure not reproduced]) was accepted for service with the **Spanish** Army in 1982. It is planned to deliver a total of over 230 of them.

The vehicle's enclosed hull is made of aluminum armor plate. The design widely uses assemblies and machine units of the BMR-600 wheeled APC. The base version of the Spanish CRV has the very same two-place armored turret as the Italian vehicle described above. A 25-mm automatic gun with coaxial 7.62-mm machinegun is installed in it. The unit of fire is 170 rounds and 400 cartridges.

The rear part of the hull accommodates the engine-transmission compartment. The engine is a six-cylinder diesel and the running gear suspension is hydropneumatic. Maximum highway speed is over 100 km/hr. The

vehicle crosses water obstacles from the move, and movement afloat at a speed of 9 km/hr is provided by two water jets.

According to foreign press announcements, the **Israeli** Army has some 400 wheeled CRV's, including the RBY Mk 1 light wheeled (4x4) vehicles (Fig. 9 [figure not reproduced]). The vehicle crew (up to eight persons) is accommodated in the hull mid-section. The commander's and driver's seats are situated in front. Up to five 12.7-mm and 7.62-mm machineguns are on ring mounts. The vehicle is distinguished by good mobility.

In 1987 the 87 wheeled (6x6) CRV (Fig. 10 [figure not reproduced]) was accepted for service with the **Japanese** Army. It was created on the basis of the 82 command and staff vehicle developed by the firm of Mitsubishi Heavy Industries in the late 1970's. The enclosed hull is welded from steel armor. The driving compartment is located in its front section to the right and the engine-transmission compartment is in the rear section. The 360° traverse turret accommodates the commander and gunner. The crew also includes a radio operator and observer situated behind the fighting compartment.

The 87 CRV is armed with a 25-mm automatic gun and coaxial 7.62-mm machinegun. Smoke grenade launchers are mounted along the sides of the turret. A ten-cylinder diesel engine is used as the power plant. The vehicle is not amphibious.

It is planned to purchase some 70 such CRV's for the Japanese Army.

In **Brazil** the state firm of Engesa is engaged in developing and producing armored equipment, including CRV's. In 1974 it began producing the EE-9 Cascavel armored vehicle, intended for reconnaissance and for fire support to infantry subunits. This armored vehicle has been constantly modernized in the process of production. A total of five models appeared, differing in the phased improvement of armament, an improvement in armor protection, and the use of more effective power plants, transmissions and running gear components. In addition, the armored vehicle has been equipped with more and more improved systems, devices and radios.

The EE-9 Cascavel (Fig. 11 [figure not reproduced]) is armed with a 90-mm gun and two 7.62-mm machineguns. The unit of fire includes 44 shaped-charge, armor-piercing-HE, HE-fragmentation and smoke rounds. The latest models of the armored vehicle have a laser rangefinder and light gathering and amplifying passive night vision instruments. A feature of the armored vehicle is the presence of a boomerang-type bogie rear wheel suspension, which gives the rear wheels great vertical play (up to 900 mm), and this in turn permits the vehicle to negotiate obstacles better on rugged terrain.

The EE-9 Cascavel armored vehicle also is in service with armies of a number of Latin American, African and Near Eastern countries.

In the late 1970's the above firm created the EE-3 Jararaca light wheeled (4x4) CRV (Fig. 12 [figure not reproduced]). Its enclosed hull is made of two-layer armor previously used in the EE-9 Cascavel armored vehicle. The driving compartment is in the front section and the engine compartment in the rear. A four-cylinder diesel engine and mechanical gearbox are installed in this CRV. A 12.7-mm machinegun is mounted on a rotating ring mount above the commander's hatch.

Work to create CRV's also has been done in other capitalist countries. For example, experimental models of wheeled CRV's have been made in Austria and Switzerland. In developing new CRV's special attention is given to using powerful armament and outfitting them with the latest reconnaissance equipment in addition to giving them high mobility and protection.

AIR FORCES

U.S. Air Force European Command

18010885E Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 31-36

[Article by Col V. Grebeshkov]

[Text] In the opinion of U.S. Air Force specialists, tactical aviation is the most flexible component of the American general-purpose forces, having great striking power, high mobility, and the capability of performing a wide range of missions both in coordination with other branches of the Armed Forces and independently. With tactical fighters (including nuclear weapon platforms), reconnaissance aircraft and EW aircraft (i.e., up to 80 percent of U.S. Air Force combat aircraft) consolidated in its makeup, tactical aviation is the largest combat aviation element of the U.S. Air Force.

Tactical aviation of the regular U.S. Air Force is consolidated organizationally in four commands: the Tactical Air Command [TAC] (in the continental United States) as well as U.S. Air Force commands in three zones (European, Pacific and Alaska).

This article, which is based on foreign press materials, gives the organization, order of battle, a brief description, and development prospects for the U.S. Air Force European Command [USAFE][1]. It represents a large formation of tactical aviation intended for accomplishing missions under present-day conditions both independently and together with air forces of NATO bloc allies. Its order of battle has a total of over 700 aircraft and helicopters, including F-111E and F heavy tactical fighters (Fig. 1 [figure not reproduced]); F-16A, B, C and D tactical fighters; F-15C and D air combat fighters; F-4G (and some F-16C) aircraft for fire suppression of air defense assets; as well as A-10 attack aircraft

(Fig. 2 [figure not reproduced]), RF-4C reconnaissance aircraft, EF-111A and EC-130H EW aircraft, EC-135 airborne command posts and CH-53 helicopters.

USAFE has 93,000 servicemen and over 11,000 civilian specialists.

In addition to organic air units, so-called "dual based" squadrons are assigned to USAFE. They are stationed in the continental United States, are included in TAC and are intended for priority movement to the European theater of war as reinforcements in case a crisis situation arises there.

In addition to tactical air formations, USAFE includes ground-launched cruise missile [GLCM] units and subunits, deployment of which began in December 1983. These are medium-range nuclear missiles and fall under provisions of the Soviet-American INF Treaty. Over 300 such missiles were deployed in Europe as of the moment this treaty was signed (8 December 1987).

In its administrative (permanent) organization USAFE (headquarters at Ramstein Air Base, FRG) is one of the main U.S. Air Force air commands and is directly subordinate to the Air Force Chief of Staff and Secretary of the Air Force. In accordance with the U.S. Air Force operational organization, it is an air component of the unified U.S. European Command. The latter's sphere of "responsibility," according to the concept of Pentagon strategists, encompasses all of Western Europe (except for Iceland), the Mediterranean basin, North Africa, and countries of the Near and Middle East. Within the framework of NATO Allied Forces, USAFE is an important component of the Allied Air Forces and the basis of their striking power.

According to western press announcements, CINCUSAFE (who is at the same time also commander of NATO Allied Air Forces Central Europe) is responsible for planning; training subordinate large and small units to conduct combat operations; ensuring their precise, swift conversion from a peacetime to a wartime footing; receiving forces from the continental United States; deploying them; and conducting air operations in the course of a war both independently and in coordination with ground and naval forces.

Organizational structure. Organizationally USAFE consists of three air forces (3d, 16th and 17th) and two ground wings of central subordination—the 7455th Tactical Intelligence Wing (Ramstein Air Base, FRG) and the 7350th Air Base Wing (Tempelhof Airport, West Berlin).

Tactical fighter wings are the basis of the air forces. In addition they have tactical GLCM wings and there may be tactical reconnaissance wings and tactical air control wings (the last two types of formations presently exist only in the 17th Air Force.

The air forces include ground support and maintenance units.

Each tactical fighter wing as a rule consists of three squadrons of 24 aircraft each. The reconnaissance wing has one squadron with 18 aircraft and the tactical missile wings have from 3 to 7 GLCM detachments (four launchers and 16 cruise missiles each).

The makeup of the air forces is nonuniform. According to an estimate of foreign military specialists, the strongest of them are the 3d and 17th air forces, which are intended for operations in the Central European sector together with large and small air force units of Great Britain, the FRG, Belgium and the Netherlands as well as with Canadian air subunits in the FRG. Organizationally they are consolidated in the 2d and 4th allied tactical air forces [ATAF] of the NATO Air Forces.

The 3d Air Force is stationed on UK territory (headquarters at Mildenhall). It includes four tactical fighter wings (10th, 20th, 48th and 81st). In addition, the 513th Airborne Command and Control Wing is based at Mildenhall and includes EC-135 airborne command post aircraft of CINCUSAFE.

The 10th Tactical Fighter Wing (Alconbury Air Base) was converted from a tactical reconnaissance wing in 1987. Two squadrons of A-10 attack aircraft assigned from the 81st Tactical Fighter Wing became part of it. In addition, a reconnaissance squadron equipped with TR-1 high-altitude aircraft (Fig. 3 [figure not reproduced]), created on the basis of the U-2 strategic reconnaissance aircraft) is deployed at Alconbury Air Base. Using onboard sidelooking radar, TR-1 aircraft are capable of conducting aerial reconnaissance of the border zone of Warsaw Pact countries without violating their air space.

The 20th and 48th tactical fighter wings are at Upper Heyford and Lakenheath air bases respectively. The 20th has three squadrons and the 48th has four squadrons equipped with F-111E and F heavy fighter-bombers that are nuclear weapon platforms (a total of 157 aircraft). These aircraft are equipped with gear for automatic low-altitude nap-of-the-earth flight and terrain avoidance. They are capable of operating in any weather conditions.

The 81st Tactical Fighter Wing is armed with A-10 Thunderbolt II attack aircraft intended for engaging tanks and other small targets on the battlefield and in the tactical depth of the enemy's defense. It has four squadrons with 18 aircraft each, permanently stationed at Bentwaters and Woodbridge air bases, but they usually practice combat training missions from airfields on FRG territory, where 6-8 aircraft are periodically based. It is reported that the U.S. Air Force command also has forward air bases in the FRG for squadrons of A-10 attack aircraft (Ahlhorn, Sembach, Nervenig and Leipheim) near the borders with Warsaw Pact countries and have assigned operating sectors which the pilots of these subunits are told to study in detail even in peacetime. The 81st Tactical Fighter Wing has the 525th Training Squadron, officially called the "Aggressor" Squadron. It is equipped with F-5E aircraft and is intended to denote actions by Soviet fighters when combat missions are practiced. It is to receive F-16 fighters.

The 3d Air Force also includes the 501st Tactical Missile Wing, stationed at Greenham Common and consisting of six GLCM detachments (24 launchers and 96 cruise missiles). The 3d Air Force 303d Tactical Missile Wing which was deployed earlier at the Molesworth Base in Great Britain was disbanded in accordance with a provision of the INF Treaty.

The 17th Air Force is based in the FRG (headquarters at Sembach Air Base). It includes two divisions (65th and 316th), two tactical fighter wings (36th and 50th), one separate squadron (32d), one tactical reconnaissance wing (26th) and one tactical air control wing (601st). In addition, the 17th Air Force has the 38th Tactical Missile Wing armed with GLCM's.

The 65th Air Division (Lindsey Air Base, FRG) consolidates all EW assets in the 17th Air Force. It includes in particular the 52d Tactical Fighter Wing (Spangdahlem Air Base, FRG), intended for engaging surface-to-air missile systems (it is equipped with F-4G Wild Weasel and F-16C ELINT and SAM system engagement aircraft) as well as the 66th Electronic Combat Wing, which performs the mission of electronic suppression of enemy radios and radars. The wing consists of two squadrons of EF-111A EW aircraft (based at Upper Heyford Air Base, UK) as well as EC-130H Compass Call aircraft (Sembach, FRG).

The 316th Air Division (headquarters at Ramstein Air Base, FRG) includes the 86th Tactical Fighter Wing (F-16C and D aircraft) and 377th Combat Support Wing.

The 50th Tactical Fighter Wing (Hahn Air Base, FRG) has three squadrons equipped with F-16C and D aircraft.

The 36th Tactical Fighter Wing (Bitburg, FRG), which includes three squadrons, and the 32d Separate Tactical Fighter Squadron (Soesterberg, the Netherlands) are equipped with F-15A, B, C and D air superiority fighters. Already in peacetime they are transferred to forces and assets of the NATO Allied Air Defense System in Europe.

The 26th Tactical Reconnaissance Wing (one squadron, Zweibrücken Air Base, FRG) is equipped with tactical reconnaissance aircraft.

The 601st Tactical Air Control Wing (Sembach Air Base) consists of several subunits and supports combat aviation headquarters and command posts in European theaters with communications and command and control assets. CH-53 transport helicopters are attached to it.

The 38th Tactical Missile Wing (Wüschheim Air Station, FRG) has four GLCM TOE detachments (it was planned to have a total of six detachments at the air station, but their deployment was halted in connection with entry into force of the INF Treaty).

The 16th Air Force is intended for operations in the Southern European sector together with air forces of Italy, Greece and Turkey (5th and 6th ATAF); the headquarters is at Torrejon Air Base, Spain. It includes the 401st Tactical Fighter Wing, 406th Training Wing, TUSLOG Air Group Headquarters, 40th Tactical Group, as well as the 487th Tactical Missile Wing.

The 401st Tactical Fighter Wing (Torrejon, Spain) includes three squadrons equipped with F-16 tactical fighters. The decision has been made that this wing will be permanently based in Italy. Its relocation is to be accomplished by 1990.

The 406th Training Wing (Zaragoza, Spain) is engaged in training flight personnel of USAFE subunits to employ on-board weapons of F-15, A-10 and F-16 aircraft. A tactical weapon employment school is attached to it and there is a range for conducting practice firings, missile launches, bombings and so on.

TUSLOG Group Headquarters is in Ankara, Turkey. It includes various subunits for supporting U.S. aircraft flights. In particular, the 39th Tactical Group supports F-16 tactical fighters (up to a squadron) from the 401st Tactical Fighter Wing, which are located at Incirlik Air Base under a "rotational" program.

The 40th Tactical Group is deployed at Aviano Air Base, Italy. It organizes communications and command and control of U.S. tactical aviation on the southern flank of the European theater of war. A detachment of F-16 aircraft, also from the 401st Tactical Fighter Wing, is considered to be its active force.

The 487th Tactical Missile Wing (Comiso Air Station, Italy) fully deployed seven GLCM detachments prior to 1988. According to foreign press announcements, steps to withdraw certain cruise missile subunits from the wing's order of battle have begun.

Coordination with other U.S. Air Force commands is organized along the following directions.

SAC assigns tanker aircraft subunits in the interests of USAFE to support tactical aircraft with aerial refueling during transatlantic flights in the course of combat training and the movement of reinforcing units. KC-135 tanker aircraft (Mildenhall and Fairford air bases) from SAC, which are replaced under the "rotational" program, as well as SR-71 (Mildenhall) and TR-1 (Alconbury) strategic reconnaissance aircraft from SAC are constantly based at UK air bases.

The Military Airlift Command [MAC] provides military transport aircraft for delivering air unit support personnel and necessary gear, organizes weather support for all airlifts, and organizes the search and rescue of crews. In this connection there are C-130 aircraft, replaced under the "rotational" program, as well as HC-130 and HH-53 helicopters of the search and rescue service that are part of MAC in Europe.

SAC and MAC deployed two air divisions in Europe, the 7th and 322d respectively, to organize effective coordination among the commands as well as with numerous allied entities.

The Air Force Communications Command supports the U.S. European air grouping with all kinds of communications and electronic navigation equipment, and provides servicing and maintenance of automated air control systems.

The Electronic Security Command deployed its own special department in Europe consisting of security wings, groups and squadrons. Their forces and assets transmit COMINT and ELINT data to CINCUSAFE, monitor the security of communications and command and control, and organize electronic countermeasures.

USAFE maintains closest coordination with TAC, which is the main facility for training combat crews and retraining air unit and subunit personnel in new aircraft. The foreign press notes, however, that the important factor is that TAC is a mobile strategic reserve of the Air Force intended for rapid reinforcement of overseas air groupings, above all in Europe.

Questions of receiving reinforcing units are decided jointly with U.S. NATO allies. In addition to the almost 30 air bases constantly used by U.S. aircraft in peacetime, they are assigned up to another 50 airfields for joint basing. Over 600 aircraft shelters already have been built at all these air bases and up to 200 are in various stages of construction. In addition, hardened command posts as well as shelters for tanker trucks and other ground equipment have been created at the bases to improve aircraft survivability.

U.S. NATO allies take on a portion of the efforts to support activities of U.S. aviation in Europe, including joint maintenance of aircraft, aircraft refueling, ammunition supply, as well as repair of aircraft damaged in combat. All these matters are regularly practiced during special exercises.

Operational and combat training. USAFE attempts to maintain a high level of combat readiness in its air units. Its crews upgrade flying proficiency and learn the features of European theaters. Much attention is given to training in operations under near-real conditions. To this end new SAM threat simulators are used widely and air combat is practiced at a special range. A special role is set aside for training jointly with the 527th Training Squadron, whose crew members are air combat instructors. They especially study and master the operating tactics of the probable enemy's aircraft as well as the combat experience gained in actual armed conflicts of recent years. Squadron pilots play the part of the enemy during exercises and practices. In the opinion of the U.S. command, this methodology permits bringing practice air combat closer to real air combat to the maximum already in peacetime and studying enemy tactics on a practical basis.

During operational and combat training U.S. tactical subunits and units practice air supremacy, interdiction, close air support, and aerial reconnaissance missions. They use over 30 ranges offered by the allies for this purpose.

According to foreign press announcements, operational and combat training of U.S. aviation in Europe is conducted in close coordination with the NATO Allied Forces.

U.S. Air Force units stationed in Europe take an active part in all exercises conducted under the plan of NATO's Supreme Allied Commander Europe and at a lower level, as well as in various competitions and other activities organized by the military leadership of individual bloc countries. Missions of coordination with allied aviation and ground forces are practiced and new tactics of conducting combat operations as well as problems of command and control and communications are studied in the process.

Questions of ensuring maximum flexibility of maneuver, precise target approach by place and time, effective command and control of aircraft at all levels, and timely and complete provision of aerial reconnaissance data to the command are decided during such exercises and competitions held under conditions which approximate combat to the maximum.

Subunits of TAC and of U.S. Air Force Reserve components intended for reinforcing the European air grouping take part in the majority of measures organized by USAFE in addition to units that are permanently part of USAFE. In accordance with the "dual basing" concept, TAC subunits annually take part in exercises such as Crested Cap, Creek Bee and so on, during which the nonstop movement of aircraft from the United States to forward air bases of the FRG and other NATO countries is accomplished with aerial refueling. Each year there are 10-15 such activities.

Development prospects. In connection with the signing of the Soviet-American INF Treaty and ongoing elimination of an entire class of missiles, the foreign mass media are actively discussing problems of possible "compensation" for missiles being removed from the inventory with other attack weapons stationed in Europe in peacetime. This problem was best revealed last year in the pages of the British JANE'S DEFENCE WEEKLY. In the opinion of its authors, under the new conditions the bulk of missions of intermediate-range missiles inevitably will be assigned to the NATO Allied Air Forces, especially USAFE. In addition to their basic combat missions (winning air supremacy and providing air support to ground forces), the role and importance of air forces in supporting the bloc's nuclear potential in the European theater of war are being strengthened.

In the weekly's assessment, the nucleus of all-weather long-range attack forces of the Allied Air Forces is to be F-111E and F heavy tactical fighters from the 20th and 48th tactical fighter wings based in Great Britain together with British and West German Tornado aircraft.

The ordnance payload of the F-111 fighter in the nuclear variant basically includes B43, B57 and B61 free-fall nuclear bombs with a yield of from 2 KT to 1 MT. The B43 and B57 bombs will be removed from the inventory and replaced with B61 bombs in the early 1990's.

In the assessment of the western press, a further buildup of their capabilities can be accomplished by transferring FB-111A medium bombers with higher performance characteristics to tactical aviation and rebasing them to UK territory.

F-16 fighters from the 50th, 86th and 401st tactical fighter wings are the USAFE's second striking force in power. Officially the F-16 tactical fighter is described as an "aircraft capable of conducting air-to-air combat and engaging ground targets." JANE'S DEFENCE WEEKLY comes out very specifically concerning its capabilities of employing nuclear weapons, since it published photographs of the F-16 in test flights with the B57 and B61 nuclear bombs on external mountings.

Special F-4G aircraft for air defense system suppression from the 52d Tactical Fighter Wing (approximately 40 aircraft) also can employ nuclear weapons inasmuch as the B28 nuclear bomb suspension mechanism has been tested on this type of aircraft. It has been reported that RF-4C reconnaissance aircraft also can carry B28 or B57 nuclear bombs (one per aircraft), but information to the effect that 26th Tactical Reconnaissance Wing aircraft have been prepared as platforms has not appeared in the western press.

In the opinion of foreign specialists, the USAFE strike potential subsequently can be strengthened considerably by placing in service a new modification of F-15E tactical fighters capable of effectively operating against ground targets to a great depth.

And finally, in the estimate of the western press, USAFE capabilities can be built up in connection with the elimination of intermediate-range missiles by permanently basing a certain number of B-52 bombers in the European zone.

According to foreign press announcements, the idea of using bombers in the European zone has received fundamental approval from the Air Force command and the U.S. Joint Chiefs of Staff.

Footnotes

1. The foreign press sometimes calls it the U.S. Air Forces in Europe—Ed.

The Problem of Detecting Stealth Airborne Vehicles

18010885F Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 37-42

[Article based on view of foreign military specialists by Lt Col A. Bokov, candidate of technical sciences]

[Text] U.S. militaristic circles are not giving up on attempts to achieve military superiority over the Soviet Union, and are placing special reliance on new kinds of technology and weapons. Under present-day conditions, when the INF Treaty eliminating intermediate and lesser-range missiles has been concluded between the USSR and United States and talks are under way about a 50-percent reduction in strategic offensive arms, Pentagon strategists' plans are placing more and more emphasis on low-signature airborne vehicles. Since 1983 the American Stealth program, aimed at working out the technology of low-signature airborne vehicles, has been covered in the western press to a lesser extent. The Strategic Defense Initiative has moved into first place in popularity. Nevertheless, implementation of the Stealth program continues at rather high rates. In the opinion of foreign military specialists, results obtained in the course of its realization will strongly influence the appearance of future airborne vehicles. It is believed that a reduction in signature will become the leading trend in military aircraft construction of the 1990's. Programs for developing the highest priority airborne vehicles of various classes having the property of a low signature serve as confirmation of this. They include the B-2 bomber, the ATF advanced tactical fighter, and the ACM cruise missile.

The signature of airborne vehicles is being reduced in various sectors of the electromagnetic spectrum: radar, optical, infrared and acoustic. Greatest emphasis is being placed on reducing radar signature inasmuch as radar presently is the basic equipment in air defense systems for detecting airborne vehicles. Technical ways of reducing the radar signature of airborne vehicles also are known: improving aerodynamic shape, using new structural materials and radar-absorbing coatings, reducing the number of antennas and so on. Judging from foreign press announcements, modern technologies created under the Stealth program permit almost a 70 percent reduction in the radar cross-section of airborne vehicles compared with that of aircraft with traditional configurations. The detection range of such a low-signature aircraft will be reduced by a third, since detection range is proportionate to the 4th root of radar cross-section values.

In forecasting the massive introduction of low-signature airborne vehicles to the inventory in the 1990's, foreign military departments are unfolding a broad complex of work to study problems of countering them. Specialists devote primary attention here to problems of increasing the radar detection range of low-signature aircraft, assuming that realization of results largely will determine the appearance of radar equipment of the 1990's.

Present R&D is arbitrarily divided into two groups. The first group of studies is being conducted within the scope of a traditional approach to solving the problem of increasing the radar detection range of targets. In particular, possibilities are being studied for increasing the energy potential of radars and increasing the sensitivity of radar receivers. A typical feature of this work is that it essentially does not consider the specifics of stealth aircraft as radar targets. Results of the work are to be used basically in modernizing exiting radars.

The second R&D group is distinguished by a great diversity of research ideas and directions and represents both completely new approaches as well as familiar ideas in theoretical radar which were not previously realized for various reasons. What is common is the researchers' attempt to take advantage of signs that are specific for low-signature aircraft (such as characteristic shapes) for increasing detection range. The need for creating fundamentally new systems and equipment as a rule is substantiated as a result of this R&D.

The problem of detecting low-signature airborne vehicles is connected with radar cross-section, the magnitude of which depends on many factors: dimensions, configurations, spatial attitude of the airborne vehicle, the material from which it is made, and the illuminating signal's frequency, polarization and shape. Even a slight change in any of these factors can lead to a substantial change (by an order of magnitude or more) in the radar cross-section value. Therefore in indicating the radar cross-section values of specific airborne vehicles the conditions under which they were obtained must be precisely specified. Foreign publications devoted to low-signature airborne vehicles, however, often ignore this rule. For example, in speaking of the radar cross-section value of a low-signature airborne vehicle, its value with the vehicle illuminated in the forward hemisphere usually is given, although the generally accepted indicator is the mean value of aircraft radar cross-section when illuminated from all directions. Because of such "little ploys," a radar cross-section value equal to 10^{-2} m^2 appears in western publications devoted to low-signature airborne vehicles.

Foreign military specialists note that the majority of authors of publications on low-signature aircraft are directly involved in their development. Therefore these articles as a rule emphasize the advantages of low-signature airborne vehicles and are silent about shortcomings or disputes. What is common in calculations of the detection range of low-signature airborne vehicles is the use of characteristics of existing air defense radars. The possibilities of improving the radars as well as changing the parameters affecting target radar cross-section usually are not examined, although specialists in the field of radar already have determined future ways of improving the detection range of this type of target based on an objective analysis of the features of low-signature airborne vehicles and the dependence of their radar cross-sections on radar characteristics.

Traditional methods of improving detection range are based on an increase in radar energy potential and an improvement in the quality of signal processing. The former can be increased by increasing transmitter output and the radar antenna's directive gain. The appearance of generator devices which will permit increasing radar transmitter output by 2-3 times is expected in the future.

An increase in directive gain as a rule is connected with an increase in antennas' geometric dimensions. The possibility of creating conformal antennas based on phased arrays for radar early warning aircraft is being studied. This type of antenna will be part of the aircraft skin, which will permit accommodating them, for example, along the entire fuselage or leading edge of the wing. Thus there is an opportunity to increase an antenna's geometrical dimensions to limits determined by the dimensions of the platform aircraft. Calculations show, however, that even increasing antenna dimensions to maximum values will increase detection range only by 60-70 percent, which will permit compensating for a decrease in target radar cross-section by 10 db. In this connection foreign specialists are directing attention to the fact that the role of ground radar systems with antennas which essentially have no limitations on geometrical dimensions is again growing.

It is planned to improve the operating quality of radar receivers above all by an analysis of the fine structure of signals based on realization of digital filtration algorithms on computers. In this connection great hopes are being placed on introducing ultrafast integrated circuits and monolithic integrated circuits in the SHF and EHF bands. Charge-coupled instruments as well as those using surface acoustic waves are being created to perform individual signal processing operations.

To increase the detection range of low-signature targets, the U.S. Air Force plans to modernize the radars of AWACS system E-3 early warning and control aircraft (see color insert [insert not reproduced]), i.e., improve digital signal processing quality using computers, in the first half of the 1990's. It is believed that the detection range of targets will increase significantly after modernization because of a 10-13 db increase in signal level, and radar operating reliability and antijam capability also will improve. Other electronics of the E-3 aircraft also will be upgraded. In particular it is planned to install direct ELINT systems for passive detection of enemy aircraft, NAVSTAR satellite navigation system gear, and 2d class terminals of the JTIDS joint tactical information distribution system.

A known method for increasing detection range is to increase the time of coherent accumulation of echo signals. An inverse aperture synthesis method has been developed based on this principle. It uses algorithms which are the inverse of those used in radar aperture synthesis modes and permits obtaining detailed ground target images based on an analysis of Doppler shifts in the signal frequency. A distinctive feature of this method is that signal accumulation occurs because of target motion and not radar antenna motion as in ordinary aperture synthesis.

The inverse aperture synthesis method was tested in ground measurement systems (radar signals of space objects were received on Kwajalein Island using radars), and in the early 1980's it was also realized in an onboard radar which underwent flight testing. The AN/APS-137 radar, intended for identifying and classifying naval targets, became the first series-produced onboard radar in which this method was used. It is installed in S-3B

Viking deck-based ASW aircraft and P-3 Orion land-based patrol aircraft. The requirement to know the distance to a target and its speed is considered to be a shortcoming of this method. Errors in determining these parameters lead to deterioration of the radar's accuracy characteristics in the inverse aperture synthesis method mode of operation.

Methods based on selecting the optimum band of radar operating frequencies are conditionally categorized among traditional methods of increasing the detection range of low-signature airborne vehicles. Presently known means of reducing signature are effective only in a limited frequency band. It is believed that the lower limit of this band is 1 GHz and the upper limit is 20 GHz. Signature reduction throughout this band can be achieved only by integrated use of different methods and equipment. Individual equipment is even more narrow-band. The 1-20 GHz band was not chosen by chance. First of all, the bulk of existing air defense radars operate in it, and so designers strive to reduce the signature of airborne vehicles specifically in this band. Secondly, there are a number of fundamental physical limitations in the path of reducing the signature of airborne vehicles outside this band.

The basis for choosing the optimum band of radar operating frequencies is the dependence of an airborne vehicle's radar cross-section on the frequency of the illuminating signal. For example, the radar cross-section of fighters with traditional configurations increases according to a law near that of linear law with a decrease in frequency (or an increase in wavelength) of the sounding signal. A similar dependence is even more strongly expressed for low-signature airborne vehicles—radar cross-section is proportionate to the square of the sounding signal's wavelength. Calculations show that the detection range of a low-signature aircraft in free space in the 1-2 GHz band is 1.75 times more than in the 2-4 GHz band, and it is 2.2 times more than in the 4-8 GHz band. In this regard foreign specialists note the increased interest in radars of the metric and decimetric bands. For several decades one of the leading radar trends was the development of bands of higher and higher frequencies, dictated by the possibility of obtaining higher resolution. The appearance of low-signature airborne vehicles again drew specialists' attention to the metric and decimetric bands.

The use of radar-absorbing coatings is an important direction in reducing the signature of airborne vehicles. It is assumed that if radars of different bands are used in air defense systems, it will be practically impossible to create an effective radar-absorbing coating for an aircraft. Ferritic radar-absorbing materials are relatively narrow-band. For example, materials known as echosorb with a thickness of 5-8 mm absorb 99 percent of the energy of an incident wave in a band of approximately 300 MHz. It is noted that it is necessary to apply multilayer coatings to reduce the signature of airborne vehicles in a broader band, but this is hardly realizable considering the fact that the specific mass of a modern ferritic coating is almost twice that of an aluminum coating. Coatings based on dielectrics have less mass, but their thickness is directly dependent on the frequency of waves absorbed. For example, to counter sounding signals of a radar operating at a frequency of 1 GHz the coating thickness must be approximately 300 mm, which naturally is unacceptable for aviation.

If the sounding signal wavelength is commensurate with the target's dimensions, the reflection will bear a resonant character dictated by the interaction of the direct reflected wave and waves bending around the target. This phenomenon contributes to the formation of strong echo signals. The resonance phenomenon also can arise on the target's structural elements. For example, stabilizers and wingtips fall in the resonance area of the E-2C Hawkeye early warning aircraft radar operating at frequencies around 400 MHz (wavelength 0.75 m). The U.S. Navy command plans to keep the Hawkeye in the inventory after the next equipment modernization.

The possibility of using two bands and changing the sounding signal frequency in accordance with target configuration is the basic idea in creating the ASTARA (Atmospheric Surveillance Technology Airborne Radar Aircraft) advanced early warning aircraft, which is intended specifically for detecting low-signature airborne vehicles. It is assumed that the ASTARA will supplement AWACS system E-3 aircraft. Flight tests of the new aircraft are planned for 1991.

Creation of over-the-horizon [OTH] radars in the United States began long before work was organized to counter low-signature aircraft, but the fact that such radars operate in the metric wave band now gives American specialists the basis to view them as an important means of detecting low-signature airborne vehicles. Therefore further development and tests of OTH radars are being conducted with consideration of their performance of the new function. U.S. Air Force specialists have been working on development of oblique incidence-backscatter sounding OTH radars since 1975. It is planned to build four radars for detecting targets approaching the North American continent from any direction except north. The latter cannot be covered because of the unstable character of propagation of shortwave band signals in high geographic latitudes.

In 1988 the U.S. Air Force conducted the first tests of an OTH radar for detecting small targets simulating cruise missiles. Its capability for detecting targets in air space between Puerto Rico and the Bermuda Islands was evaluated. The radar operates in the 5-28 MHz band. Higher frequencies in this band were used in the daytime and lower frequencies at night because of the ionosphere's influence. Cruise missiles were simulated by AQM-34M drones launched from an NC-130 platform aircraft. They flew at various altitudes (150, 4,500 and 7,500 m) at a speed of 650-750 km/hr. A U.S. Air Force representative declared that the tests confirmed the possibility of an OTH radar detecting small targets at a distance up to 2,800 km. Based on their results, the decision was made to increase the size of the receiving

antenna of the radar being built on the U.S. west coast from 1,500 to 2,400 m, which will permit doubling radar receiver sensitivity. It is planned to conclude development of a system of four OTH radars in the 1990's.

The U.S. Navy is developing the ROTHR transportable OTH radar, the basic advantage of which is considered to be its capability of being moved to previously prepared positions in a relatively short time period. This radar supports the detection of aircraft at distances of 925-2,700 km in a 60° sector. Its electronics are accommodated in 30 vans. Antenna fields are being created in potential areas of combat operations, to which vans with equipment will be transported in case crisis situations arise. According to a statement by a Raytheon representative, a prototype of the radar already has been positioned in the state of Virginia and subsequently it is planned to rebase it to the Aleutian Islands. Other positions have not yet been selected for the radar, but it is proposed to deploy at least nine radars, above all in sea or ocean theaters of operations, where they will be used together with E-2C Hawkeye and E-3 Sentry early warning aircraft.

U.S. Air Force specialists are studying the possibility of creating an artificial ionospheric mirror to improve the functioning quality of OTH radars. In their opinion, it will facilitate a more focused reflection of sounding signals, which will increase resolution and will permit detecting targets at distances of less than 500 km.

Even the most ardent supporters of OTH radars admit their serious inherent shortcomings: poor resolution and weak antijam capability. Nevertheless, in the opinion foreign experts, OTH radars are the only type of system which can be placed in service with a number of western countries in the future and support detection of low-signature airborne vehicles. All other types of systems, no matter what advantages they may have, are in earlier stages of development.

The above approach to optimum band selection was oriented toward increasing the wavelength of sounding signals compared with those being used in modern air defense radars. The foreign press also is discussing an alternative path consisting of shifting to the millimeter wave band. Inasmuch as it is believed that radar-absorbing materials which are most effective in the millimeter band presently are lacking, therefore radars operating in the millimeter wave band can become an important component of future air defense systems. Millimeter band development is going on at fast tempos. An element base and principles for constructing systems operating at frequencies of 30-40 and 85-95 GHz already have been worked out, and models with operating frequencies near 140 GHz also are being created.

Nontraditional methods for increasing the detection range of airborne vehicles with low radar cross-sections are based on new approaches (time-and-frequency and spatial) to solving the problem. Methods of forming and processing new spread spectrum radar signals are being studied within the scope of the time-and-frequency approach.

The use of sounding signals matching target shape permits considerable amplification of echo signals. This method is similar to the method of matched filtration being used in modern radars. Sounding signals are formed on the basis of the target's pulse characteristic, which depends on its configuration, spatial attitude and movement dynamics. In practice, matching signals with a target requires pulses of nanosecond length. Nonsinusoidal signals are a particular occurrence of such pulses. Their important features include a super-wideband nature. As an example, the foreign literature examines signals occupying the 0.5-10 GHz band and having a duration of 0.1-1 millisecond. Their use provides a range resolution within limits of 0.15-0.015 m. Reflections from a target represent a set of echo signals from several point reflectors distributed over the target surface, which permits constructing a model of reflections from a specific airborne vehicle, with which the shape of sounding signals is matched. Calculations show that ferromagnetic materials weakly absorb the energy of nonsinusoidal radar signals.

Inasmuch as information on the configuration of an airborne vehicle can be used to increase detection range of airborne vehicles with low radar cross-sections, foreign military specialists are considering possible measures to conceal it. They include the following among such measures: accommodating airborne vehicles in shelters; selecting locations rationally and limiting training flights in daylight to reduce the probability of various reconnaissance assets obtaining photographs of airborne vehicles; improving simulator systems and shifting the center of gravity of flight personnel training to simulators; outfitting low-signature airborne vehicles with devices that increase and distort the aircraft's radar cross-section, since the probable enemy may obtain information on actual radar cross-sections when training flights are conducted within the coverage of radars of civil aviation air traffic control systems.

The time-and-frequency methods of detecting low-signature airborne vehicles also include using radars with multifrequency signals. In this case the target is illuminated by several continuous wave signals simultaneously on different frequencies. Echo signals are received and processed using a multichannel receiver. Signal pairs are formed in each channel at close frequencies, then they are multiplied and integrated or undergo Doppler filtration. The advantage of multifrequency radar consists of the possibility of selecting a set of frequencies providing maximum detection range. As in the previous method, target configuration is the determining parameter.

Possibilities of using the "nonlinear radar" effect also are being studied to improve detection range of airborne vehicles with low radar cross-sections. The effect consists of the fact that on being irradiated, equipment

objects not only reflect incident waves, but also generate re-emission on harmonics. Sometimes this phenomenon is called the "rusty bolt" effect, since connections of metal components are in part a source of harmonic oscillation. But semiconductors also have a similar property. The latter circumstance sparks researchers' interest in connection with airborne vehicles being outfitted with multifunction active phased arrays in which it is planned to use gallium arsenide components. Emission level drops sharply with an increase in the harmonic number. This is why only emissions on second and third harmonics are of practical interest.

Judging from western press announcements, all methods of the time-and-frequency group still are in early stages of theoretical and experimental research and development and so their realization will become possible only in the distant future.

Methods and means based on airborne vehicle radar cross-section as a function of the direction of illumination are being developed within the framework of the spatial approach to increasing detection range of low-signature airborne vehicles. As a rule, designers of such vehicles are succeeding in decreasing the radar cross-section value chiefly when illumination is in the forward hemisphere.

Specialists' interest has grown in recent years in so-called multiposition radars, which represent a set of several interworking transmitters and receivers separated in space. The simplest multiposition radar, consisting of one transmitter and one receiver, is called a bistatic radar. Principles of constructing multiposition radars were known back at the dawn of radar, but certain technical problems such as supporting data transmission for synchronizing transmitters and receivers did not find a satisfactory solution in those years. Therefore further development of radar followed the path of improving single-position systems.

An important parameter of bistatic radars is the angle between directions from the target to the transmitting and receiving positions—the so-called bistatic angle. Special attention is given to research on radars with a bistatic angle equal to 180 °, i.e., when the detected airborne vehicle is on a straight line connecting the transmitter and receiver. In this case the airborne vehicle's radar cross-section increases greatly (by tens of decibels) as a result of an effect known as "forward scatter." In the first approximation the "forward scatter" radar cross-section equals the ratio of the square of the illuminated area of an airborne vehicle to the square of radar transmitter wavelength multiplied by a factor of 12. Inasmuch as "forward scatter" radar cross-section is independent of the material from which the airborne vehicle is made, the effect of using composite materials and radar-absorbing coatings in low-signature airborne vehicles will be neutralized. The magnitude of the "forward scatter" radar cross-section decreases with a decrease in bistatic angle, but even at an angle of 165° it is still considerably more than for a single position radar.

The foreign press proposes different variants for building multiposition radars differing chiefly in the method of organizing target illumination. Radars of early warning systems and of integrated reconnaissance and strike systems, space-based radars, or even television broadcasting stations can be used as transmitting stations. The possibility also is being considered of introducing a multiposition mode to existing radars and creating radar nets on their basis.

The use of space-based radars will permit illuminating airborne vehicles from above. Here the airborne vehicle's radar cross-section will increase because of an increase in illuminated area. At the present time specialists of the United States, Great Britain and Canada are fulfilling a joint program for creating a space-based radar intended for detection and early warning of a raid by bombers and cruise missiles. At the same time, demands being placed on the space system by each of the countries have their own features.

UK specialists believe that a space-based radar also has to support the tracking of ground and naval objects, including on the battlefield. In their assessments, tracking naval targets presents no serious technical difficulties, but realizing the capability of tracking targets on the battlefield will require a large volume of research. A synthetic aperture radar is considered to be the most suitable type of radar for accommodation on a space platform.

Canada is participating in a number of projects together with the United States in support of air defense of the North American continent, including modernizing the ground radar network, creating OTH radars, and expanding zones monitored by E-3 aircraft. But representatives of the Canadian Ministry of National Defense consider space-based radars the sole means which can support surveillance of the country's entire territory including adjacent air space and sea areas. In addition to solving the basic problem, in their opinion such a station must perform the functions of search and rescue, navigation, and air traffic control systems. Initial plans provide for inserting 4-10 radar-equipped satellites into low polar orbits. To improve system survivability U.S. Air Force specialists are considering the possibility of creating a space-based distributed radar. Joint functioning of the "galaxy" of satellites will permit realizing an extraordinarily large overall system aperture. Proposals to accommodate radars on dirigibles or balloons which support the ascent of a payload weighing up to one ton to a height up to 25 km also are being advanced as intermediate solutions.

In parallel with development of radars, the United States is preparing an experiment to place an infrared telescope in orbit as a means of detection with a passive operating mode and higher resolution. It was planned to place the telescope in orbit in March 1986 using the Shuttle spacecraft, but the disaster of the Challenger craft delayed the experiment for several years.

In assessing the problem of improving detection range of low-signature airborne vehicles as a whole, foreign specialists note that intensive theoretical and experimental work has been going on in all possible directions. Individual results may be realized in the near future after reliable information is obtained about what methods and means of reducing the signature will find practical embodiment in aircraft of the 1990's. Radar specialists are optimistic, since the history of equipment development shows that radars always had advantages over countermeasures, and this situation apparently will be preserved even in the foreseeable future.

The problem of combating Stealth aircraft troubles foreign military specialists to a lesser extent. It is believed that with reliable detection and tracking they can be destroyed with a given probability both by existing and by future surface-to-air missile weapons.

U.S. System 414L Over-the-Horizon Radars

18010885G Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 42-44

[Article by Col A. Almazov]

[Text] The United States is intensely carrying out measures to upgrade equipment for detecting and tracking airborne targets, and above all small, low-altitude targets of the cruise missile type. The Pentagon links special hopes for increasing the range of their detection with the deployment of over-the-horizon [OTH] radars of the 414L system.

In 1975 the U.S. Air Force awarded General Electric an order to develop and build an experimental two-station oblique incidence-backscatter sounding OTH radar of the 414L system. Such a radar was built in 1977 with an azimuthal operating sector of 30°. To keep the transmitting antenna's CW sounding signal from affecting the receiving antenna, they were separated by 177 km. Transmitter and receiver operation is synchronized on LORAN-C radionavigation system signals. The working sector was expanded to 60° (from an azimuth of 16.5° to 76.5°) by 1981 after the radar's modernization.

After successful test operation of the OTH radar, in 1982 the U.S. Air Force decided to deploy this radar's combat version, the AN/FPS-118 OTH radar, in the state of Maine for covering the eastern sector and to build a similar radar in the northwestern continental United States during 1989-1991 for covering the western direction. In addition, it is planned to place radars on the territory of the states of Minnesota and North and South Dakota to cover the southern direction, and in Alaska to cover the northwestern direction. Due to heavy attenuation of OTH radar signals in the polar areas, however, characterized by instability of the ionosphere's state, it is planned to cover the northern sector with a network of conventional "Northern Warning System" radars (a modernization of the DEW distant early warning line deployed along the 70th parallel).

According to foreign press announcements, the AN/FPS-118 combat version of the radar was placed in operation in Maine in December 1987 with limited capabilities (the radar's performance characteristics are given below).

Target detection range, km	800-3,700
Azimuthal search sector, degrees	180
Form of emitted signal	FM/CW
Operating frequency band, MHz	5-28
Signal modulation frequency, Hz	20, 30, 45 or 60
Radiating power, megawatts	1.2
Antenna system length, m:	
Transmitting point	1115
Receiving point	1594

The **transmitting point** of the AN/FPS-118 (located in Caratunk) includes three identical antenna fields providing surveillance within limits of 180°, a transmitter, a sounding signal and beam former, as well as a Univac-1616 computer for controlling operation of the transmitting point. An antenna system (Fig. 1 [figure not reproduced]) representing a linear phased array of six sections with 12 masts each on which emitters are mounted for six frequency subbands is deployed at each antenna field. The subbands are 5.00-6.74 MHz (subarray A); 6.74-9.09 MHz (B); 9.09-12.25 MHz (C); 12.25-16.50 MHz (D); 16.50-22.25 MHz (E); and 22.25-28 MHz (F). Antenna elements are mounted at a height of 14-30.5 m.

The sounding signal is formed in the master oscillator, from which the signal goes to the transmitting beam former. Here the signal divides into 12 amplification and phasing channels, where the phases necessary for azimuthal beam scanning are established using converters. Each formed signal is amplified in its own power amplifier, the final stages of which have water-cooled tetrodes. They provide a nominal output of 100 kw. The amplified signals go to 12 elements of the phased array's subarray in the selected band. Beam scanning in range is achieved by changing the frequency of the sounding signal.

The **receiving point** (Columbia Falls) consists of three identical antenna fields situated at an angle of 60° to each other as well as a receiver, beam former, and radar signal primary processor.

An antenna system with an overall length of 1,594 m and height of 15 m is deployed at each antenna field. The antenna forms a beam 2.5° wide which shifts in azimuth within limits of 60°. Received signals go to the receivers, whose input stages use field-effect transistors to reduce noise level. The dynamic range of receivers is 114-124 db. Doppler processing of signals in the receiver permits the OTH radar to track moving targets whose signal level is 50 db lower than reflections from the underlying surface.

The **command and control and data processing point** (Bangor) includes a Univac-1110 high-speed computer for controlling operation of the OTH radar, data processors, air situation display devices, communications equipment and radar operation monitor systems. Information is displayed both in graphic and digital form. The control point is manned by 85 persons. Each operation (detection and tracking of airborne targets, analysis of radio wave propagation, and others) is performed by an operator especially assigned for this. For example, the radio wave propagation conditions analysis operator sets the band of frequencies necessary for emission on his console's patching panel. The band is chosen based on the range of the zone that can be scanned and the state of the ionosphere. Analysis is done in real time by special ionospheric sounding stations, information from which goes to the control point computer. To obtain frequency-altitude characteristics of the ionosphere these stations emit signals with an output up to 5 kw in the 2-30 MHz band with a repetition period of 100 kHz. Their operation is synchronized using the LORAN-C radionavigation station in Caribou, Maine.

The characteristics assessment operator compares the amplitudes of signals reflected from targets with the noise level and determines the possibility of locking onto a target for tracking and obtaining its characteristics. Data received in the process of target tracking are sent to the display, where a geographic grid and outlines of the continents are highlighted. Target returns are displayed in the form of short vertical lines.

To identify targets, the correlation and identification operator is provided with information issued by the U.S. air traffic control system about the time and routes of flights passing through the OTH radar operating sector. These data are input to the control point computer.

The AN/FPS-118 OTH radar can operate in three modes: normal, interrogate, and combination. In the normal mode each of the three antenna systems detects targets in a 30° zone in azimuth and 900 km in range. The position of these zones in azimuth and range of detection within the 60° surveillance sector of each antenna is established by the control point computer within limits of from 900 km to maximum range. Four sectors 7.5° wide are illuminated in succession within limits of the 30° zone of the transmitting antenna. Reflected signals within limits of each of these sectors are received by receiving antennas on four beams with a width of 2.5 °.

The interrogate mode provides for each antenna's surveillance of its own narrow sector of 7.5° within limits from 800 to 3,700 km. The mode is used for detailed surveillance of the most dangerous sector and for obtaining refined data on target range and azimuth.

In the combination mode one scan cycle in a normal mode and one cycle in an interrogate mode occur successively. It is believed that use of this mode permits combining surveillance within limits of 900 km in range with the possibility of detailed monitoring of the most dangerous sector.

Information received from the OTH radar makes it possible to increase the warning time about an enemy air raid on U.S. territory from the direction of the Atlantic to 1-1.5 hours. It is transmitted to the NORAD command post and air defense area control centers for ensuring timely deployment of E-3 early warning and control aircraft of the AWACS system and fighter-interceptors to threatened axes.

The U.S. Air Force conducted tests of the AN/FPS-118 OTH radar in 1988. The purpose of the tests, which include detecting unmanned airborne vehicles in airspace in the area between Puerto Rico and the Bermuda Islands, was to determine the OTH radar's effectiveness in detecting and stably tracking targets of the cruise missile type, as well as to evaluate necessary improvements providing maximum opportunities for action against future airborne targets.

The test program included collection of the following data:

—Detecting airborne targets day and night using signals in the 5-28 MHz band; a higher frequency band of signals was used in daytime and a low-frequency band at night;

—Possibility of detecting airborne targets at ranges of 4,000 km;

—Detection and tracking of small targets flying at altitudes of 150, 4,500 and 7,500 m at speeds of 650-750 km/hr.

Modernized AQM-34M drones controlled from aboard an NC-130 mother aircraft were used as airborne targets. The NC-130 aircraft were rebased from Hill Air Force Base, Utah to Puerto Rico for conducting the flights. Seventeen AQM-34M drones (Fig. 2 [figure not reproduced]) also were delivered there. After releasing the AQM-34M the NC-130 aircraft would follow it at a distance of 300 km, controlling its flight. Maximum flight range of the drone was 1,800 km. After performing a flight with given parameters, the AQM-34M landed on the water by parachute, then was raised by an HH-3 helicopter or hoisted aboard a special vessel.

In 1988 there were 25 tests conducted to detect AQM-34M airborne targets. Judging from western press reports, the tests demonstrated rather high effectiveness of the AN/FPS-118 OTH radar in detecting small, low-flying targets and permitted developing a number of measures for further improving its operation. In particular, to double the radar's sensitivity it is planned to increase the length of the system receiving antenna to 2,400 m; and new algorithms are being developed for more stable tracking of airborne targets, with a separate algorithm for tracking cruise missiles. These changes will be realized in all system 414L OTH radars.

Reconnaissance Air Meet-88 Competition Exercise for U.S. Air Force Tactical Reconnaissance Aircraft Crews

18010885H Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 44-45

[Article by Lt Col M. Nepomnyashchiy]

[Text] Various competitive exercises have become widespread in U.S. Air Force tactical aviation as an effective form of crew combat training. It is believed that exercises of this type improve the effectiveness of combat training, contribute to attaining higher indicators and permit objectively identifying and comparing the level of proficiency actually achieved by unit and subunit flight and ground personnel. By decision of the U.S. Air Force Tactical Air Command, Reconnaissance Air Meet competitive exercises have been held regularly once every two years since 1986 for tactical reconnaissance aviation crews. Experience of previous similar activities such as Best Focus and Big Click is considered in organizing them.

The Reconnaissance Air Meet-88 competitive exercise was held during 16-26 August 1988 at Bergstrom Air Force Base, Texas. Its objective was to determine the actual status and combat capabilities of aerial reconnaissance systems in the inventory as well as the training level of all categories of personnel—flight crews, ground personnel and aerial photointerpreters. No small significance also was attached to an exchange of aerial reconnaissance experience among various air units.

Fifteen teams took part in the competition from various U.S. Air Force commands—TAC, USAFE, PACAF, National Guard—and from Naval Aviation and Marine Aviation in RF-4B and C and RF-14 aircraft, as well as from Australia in RF-111 aircraft and for the first time from the FRG Air Force in RF-4E's. A total of some 650 persons were in action in flight crews and ground services. Fighter-interceptors, tanker aircraft and E-3 early warning and control aircraft as well as U.S. Army National Guard subunits which denoted "enemy" forces were used to support the competitive exercise.

The activity began with fulfillment of a number of preliminary exercises, results of which were not included in the overall score. In particular, flight crews competed in accuracy of approaching the target, aerial photography material processing specialists competed in the speed of performing operations to remove aerial photographic equipment from aircraft, and so on (see figure [figure not reproduced]).

The main phase of the competitive exercise was conducted in two periods lasting a week each in accordance with a special scenario. One period was devoted to conducting aerial reconnaissance at night and the other in the daytime. This phase was characterized by high saturation with various scenario instructions, the objective of which was to comprehensively check participants' knowledge and skills, above all in reliable detection and faultless identification of targets, processing photographs, and timely compilation of intelligence reports. Results of all crews were shown on display boards by the end of each day.

Results of the activity showed a rather high training level for participants. This resulted in a fierce contest in all points of the program, and winners were identified with only a slight point advantage.

Noting the positive effect of the competitive exercise on the course of combat training of air force units of the United States and other participating countries, foreign military analysts direct attention to the period of intensive training that preceded it (from the spring of 1988), during which various practices and screening-and-selection competitions were held in national air forces to identify the best specialists.

Along with the exercise's positive results, western military specialists also note a number of shortcomings. For example, a conclusion was drawn about the obsolescence of NATO's main tactical reconnaissance aircraft, the RF-4, and the urgent need to replace photo reconnaissance gear installed in it with electro-optical equipment. At the same time attention was directed to individual organizational deficiencies to which foreign participants in the competition were sensitive—the absence of an acclimatization period for their team members as well as the absence of an opportunity to perform familiarization flights.

The next competitive exercise of this type is planned to be held at an American air base in 1990. The FRG is showing a great interest in it, and its Air Force command deems it advisable not only to take part, but also to increase the team's composition, giving it representation from both Air Force air reconnaissance squadrons (in 1988 the team of 46 persons represented only the 52d Aerial Reconnaissance Squadron—three flight crews in four RF-4E aircraft, two groups of aerial photointerpreters, and ground personnel delivered to the United States aboard a C-160 aircraft).

Improving the U.S. Air Force Transport Aviation Command and Control System

18010885I Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 45-46

[Article by Col L. Konstantinov]

[Text] Military transport aviation plays an important role in supporting combat operations of ground forces, other air arms, and naval forces and is one of the principal elements in achieving strategic mobility of armed forces. Its main forces and assets are consolidated in the U.S. Air Force Military Airlift Command [MAC].

MAC's zone of responsibility takes in practically the entire world, and the aircraft included in it (up to 1,000,

chiefly C-5, C-141 and C-130 aircraft of various modifications) use more than 320 airfields in 26 countries for basing. According to western press announcements, in 1987 MAC aircraft carried over 462,000 tons of cargo and 2,140,000 persons. Each day MAC aircraft fly from 500 to 1,000 sorties. Air movements are especially intensive in periods of large-scale maneuvers involving participation of American Armed Forces in Europe and in the Near and Far East.

U.S. Air Force experts admit that over the last 10-15 years more and more problems have begun to appear in command and control of military transport aviation, including in the organization of its coordination with other air arms. Similar difficulties also arose in other branches of the Armed Forces, which showed up in particular during the American intervention on Grenada and forced the U.S. Defense Department in 1985 to decide there was a need for a substantial improvement in command and control and communications systems in the Armed Forces.

In fulfilling that decision, MAC began development and creation of a so-called Global Decision Support System, or GDSS, which began functioning in February 1988. It includes the main military transport aviation flight control center at Scott Air Force Base, Illinois and six regional centers at McGuire Air Force Base [AFB], New Jersey (21st Air Force), Travis AFB, California (22d Air Force); Hurlburt Field, Florida (23d Air Force); Ramstein, FRG, Land Rheinland-Pfalz (322d Airlift Division); Hickam AFB, Hawaii (834th Airlift Division); and Andrews AFB, Maryland (Air National Guard Command). All GDSS centers are equipped with modern computers connected to the armed forces information system known as DDN (Defense Data Network) via ground and satellite communications channels, as well as numerous data display equipment and varied high-capacity communications equipment. As noted by the journal AVIATION WEEK AND SPACE TECHNOLOGY, a distinctive feature of the GDSS is the presence of a mechanism for automatic backup of data input to computer memory of one of the command and control centers in all other system centers (the time gap does not exceed 10 seconds for the backup). The volume and kind of data being accumulated and stored in the computer memory of each of the seven centers is identical and all command and control centers retain combat effectiveness when one or more data banks malfunction inasmuch as they can use the storage of other computers in the GDSS.

In day-to-day work the primary load falls on the main military transport aviation flight control center. In addition to directing MAC aircraft flights, its personnel monitor the location and technical status of MAC reserve aircraft in civilian airlines (their number varies and now is around 350 passenger and transport aircraft) with which MAC periodically contracts in peacetime. In case of mobilization these aircraft are placed at the disposal of the Defense Department. The main working spaces of the new flight control center are the main operations room (see figure [figure not reproduced]), a crisis room outfitted with 43 work stations, and a data-command post for directing top secret operations (the communications lines and room of the latter are protected against intercept and bugging by additional equipment). Only the main operations room is used in an ordinary situation.

The information stored in the GDSS system computer memory (intelligence, weather, aircraft and crews in the air and on the ground, presence of spare parts at logistics depots, POL reserves, maps, diagrams, aerial photos and so on) can be displayed in textual or graphic form, generalized or by individual items on display screens installed at operator work stations, and also on a large screen (4.6x9.75 m) in the operations room using two laser projectors. The modern equipment allows maintaining direct communications both with the country's supreme political and military leadership and the Air Force command as well as with large and small MAC units and subunits and with crews of any military transport aircraft no matter where they may be.

Work experience of the military transport aviation main flight control center and of the entire GDSS system as a whole is being studied carefully by specialists not only of the Air Force, but also of other branches of the U.S. Armed Forces. It is believed that it can be useful in creating command centers and global command and control systems in the near future.

NAVAL FORCES

U.S. Marine Expeditionary Brigades and Their Coordination with Maritime Prepositioning Squadrons

18010885J Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 47-54

[Conclusion of article by Capt 1st Rank Yu. Kravchenko]

[Text] The previous issue of the journal[1] showed the concept of prepositioning weapons, military equipment and logistics for Marine expeditionary brigades [MEB's], their organization and combat capabilities, and a description of depot ships. Questions dealing directly with MEB deployment to mission areas are examined below based on foreign press data.

In the opinion of American military specialists, the use of depot ships opens up fundamentally new opportunities for improving the strategic mobility of Marine expeditionary units. Maritime prepositioning squadrons are situated in zones of so-called U.S. "vital interests" and can reach areas of presumed conflicts in 3-7 days.

The fact that personnel of expeditionary brigades stationed on U.S. territory who are being moved have no heavy weapons, military equipment, and supplies necessary for conducting combat operations makes their airlift to "hot spots" easier. For example, it takes 249 sorties of C-141B Starlifter and C-5B Galaxy strategic (heavy) military transports or Boeing 747's brought in by mobilizing civil aviation aircraft to deliver MEB personnel to a mission area, while a U.S. Army light infantry division will require 500 sorties. It should be borne in mind that in comparison with a light infantry division, the MEB has considerably greater firepower in artillery, armored vehicles and aviation.

The 7th MEB, formed from Pacific Fleet Marine forces, is intended for conducting independent operations or operations with other branches of the Armed Forces, above all in the "zone of responsibility" of the unified Central Command, which in the western press goes by the name CENTCOM, or Central Command. This zone includes countries of Southwest Asia, the Near and Middle East, and North and Northeast Africa (Afghanistan, Bahrain, Djibouti, Egypt, Iraq, Iran, Jordan, Yemen Arab Republic, People's Democratic Republic of Yemen, Qatar, Kenya, Kuwait, United Arab Emirates, Oman, Pakistan, Saudi Arabia, Somalia, Sudan and Ethiopia). It takes 5-7 days to move the brigade by air to this area from the California coast where its forces are permanently stationed, and placing the 7th MEB in full readiness to conduct combat operations will be accomplished in 10 days from the moment the deployment order is received. It will be provided weapons, military equipment and supplies for 30 days of combat operations from depot ships of the 2d Squadron prepositioned at Diego Garcia Atoll. Up to 40 military installations (bases, ports, airfields, naval basing facilities) on the territories of some of the countries indicated above can be used to receive the forces being moved.

If necessary, an operation to seize a beachhead (port, coastal sector, airfield) can be conducted before the brigade's arrival in the mission area by forces of a Marine expeditionary battalion, which is already in the region in peacetime aboard ships of an amphibious assault group. The numerical strength of a Marine expeditionary battalion can reach 2,500 persons, and it is equipped with five M60A1 (M1A1) tanks, six 155-mm towed howitzers, 14 amphibious APC's, 12 LAV combat vehicles, some 20 60-mm and 81-mm mortars, 40 TOW and Dragon ATGM systems, and some 40 aircraft and helicopters. It will require up to two days to land the Marine expeditionary battalion and conduct an operation to capture a beachhead. In addition the 7th MEB also can operate outside the CENTCOM "zone of responsibility" if the need arises.

The 6th MEB is being prepared for operations in the European theater of war (the 1st Maritime Prepositioning Squadron assigned to it is stationed in the East Atlantic), and the 1st MEB with the 3d Maritime Prepositioning Squadron (Island of Guam) is oriented toward Southeast Asia and the Far East.

MEB's operating together with maritime prepositioning squadrons can accomplish the following primary missions: capture enemy bases for use in the interests of the U.S. Armed Forces; reinforce forward groupings; take key areas located along strategic ocean or sea lines of communication; reinforce a grouping conducting an amphibious landing operation; assist forces advancing in coastal sectors to defeat the opposing enemy force groupings; show force and exert political pressure on progressive governments objectionable to Washington; and give military support to U.S. allies (reinforcement of armed forces of allied states). It is apparent from this that the MEB can conduct both independent as well as joint operations with large units of other branches of the Armed Forces.

According to existing U.S. law, the order for employing Marine expeditionary units can be issued by the president without Congressional approval. The operation to deploy an MEB with the assigned maritime prepositioning squadron will be conducted under the overall direction of the fleet CIC in accordance with a directive of the JCS or of the theater armed forces CIC.

On receipt of the directive for conducting an operation, a task force is formed which includes the MEB, a maritime prepositioning squadron, as well as support units and subunits assigned from the fleet.

The following are the main phases of an operation to deploy an MEB with a maritime prepositioning squadron: working out its concept and planning; concentration of forces, their preparation for departure, and the movement (flight) of large unit forces to the mission area; unloading depot ships and receiving airlifted personnel, equipment and cargoes; advance of the MEB into the combat zone and its accomplishment of missions ashore.

Working out the concept of the operation and planning are done on the basis of the directive of the JCS (or CIC of U.S. theater forces). In accordance with the directive, the CINC Atlantic (or Pacific) Fleet determines the objective and missions of deployment of the MEB and of its operations ashore, assigns a task force commander (if not done earlier), and determines the organization of command and control in all phases of the operation, depot ship unloading areas, destination airfields of the MEB forces, and organization of cover for the maritime prepositioning squadron on the sea transit and in unloading areas.

Fragmentary plans are compiled on the basis of the general plan which detail individual elements of the task force that has been established: flight schedules for MAC aircraft and tanker aircraft assigned from SAC, arrival time in designated areas, order of depot ship unloading, and problems of coordination with other branches of the Armed Forces. Plans not only have to be detailed, but also extremely flexible so that it is possible to promptly take account of a change in the situation.

Concentration of forces, preparation for departure, and movement (flight) of large unit forces to the mission area.

Forces assigned to the MEB as well as units and subunits assigned from the fleet arrive in departure airfield areas, where they are loaded on military transport aircraft according to plan. The personnel departure schedule as well as aircraft loading variants are coordinated with MAC by the MEB commander. Based on exercise experience, an airlift control center is established with the MEB headquarters and corresponding teams are formed at each departure airfield. A similar control entity also is formed for the period of an operation with the headquarters of the MAC air force being used. For example, in Exercise Stratobex-2/87 (April 1987) an airlift control center functioned at the Camp Pendleton base and control teams functioned at March, El Toro, 29 Palms and Camp Pendleton air bases for moving a portion of the 7th MEB forces. C-5B Galaxy and C-141B Starlifter heavy military transport aircraft of the 60th Military Airlift Wing (Travis AFB, California) as well as SAC KC-10A Extender tanker-transport aircraft were used for the exercise. Forty five sorties were flown and some 1,000 persons and 2,000 tons of cargo were moved from Southern California to McChord AFB, Washington in a period of 68 hours.

Performance characteristics of C-5B and C-141B aircraft are given below.

	C-5B Galaxy	C-141B Starlifter
Maximum take-off weight (empty aircraft), tons	380 (168)	156 (65)
Maximum cargo weight, tons	118	42
Number of Marines carried	345	154
Cruising speed, km/hr (at altitude, m)	830 (7,600)	800 (10,000)
Range, km (with load, kg)	5,480 (118,400)	4,730 (42,000)

In addition to Marines, the C-5B Galaxy (Fig. 1 [figure not reproduced]) is capable of taking aboard large cargoes such as heavy assault transport helicopters. The rear part of the aircraft's upper deck accommodates 75 seats for carrying personnel, and the lower deck is a cargo cabin 37 m long, 5.8 m wide and 4.1 m high (it also can be refitted to carry 270 persons with weapons). There are two cargo hatches for loading and unloading operations: forward (5.79x4.1 m) and rear (5.79x3.93 m).

The C-141B Starlifter heavy military transport aircraft has a cargo cabin with the following dimensions: length 31.8 m, width 3.1 m and height 2.8 m. Loading and unloading is through the cargo hatch (3.15x2.77 m) located in the rear of the aircraft. According to foreign press data, the U.S. Air Force MAC has 67 C-5A and B Galaxy aircraft (four squadrons) and 218 C-141B Starlifter aircraft (13 squadrons). The Air Force Reserve has one C-5 Galaxy squadron (eight aircraft) and one C-141 squadron (eight aircraft). Four crews have been trained for each of the strategic transport aircraft in Air Force regular and reserve components, which permits planning lengthy, continuous operation of these aircraft. In addition, it is possible to use civil aircraft (Boeing 747's, Fig. 2 [figure not reproduced]) for airlifting an MEB.

It requires 249 sorties, including 11 C-5, 197 C-141 and 41 Boeing 747 (one of the variants), for airlifting MEB forces. In this case some 87 percent of the MEB personnel will be carried aboard Boeing 747 aircraft. Three mobilization readiness precedences have been established for these aircraft and their crews, each of which specifies the number of aircraft and time periods for shifting flight personnel to a military status. According to American specialists' calculations, the necessary number of Boeing 747's can be provided within 48 hours (second readiness precedence). Overall coordination from the standpoint of making most effective and expedient use of military transport aircraft is exercised by the Unified Transportation Command (Scott AFB, Illinois).

Aircraft of the composite MEB air group fly independently to the operation area. All matters involving the flight are worked out in the planning phase: routes, aerial refueling, intermediate airfields, and organization of search and rescue operations if necessary. Aircraft can be refueled en route by tanker aircraft from Marine aviation and SAC.

The maritime prepositioning squadron transits under the direction of the CIC of the corresponding operational fleet and the transit is strictly coordinated with the schedule for airlifting MEB forces. He assigns the necessary number of ships to squadron escort forces for the sea transit and organizes defense of unloading points.

A maintenance aviation/support ship can be brought in from among auxiliary ships for an operation to deploy an MEB. There are two such ships in the U.S. Navy Reserve, the T-AVB 3 "Wright" and T-AVB 4 "Curtiss," converted from commercial containerships during 1986-1987. The vessels are intended for maintaining and repairing aircraft and helicopters of Marine expeditionary units in forward zones and for carrying containerized cargoes. Judging from foreign press announcements, the readiness of such a vessel for departure is maintained within limits of 10 days. The presence of the maintenance aviation/support ship in expeditionary forces relieves military transport aircraft of flying another 160 sorties (over the 249) necessary for delivering appropriate logistics to the brigade deployment area in airlifting the MEB.

A hospital ship, the T-AH 19 "Mercy" or T-AH 20 "Comfort" (converted from tankers under FY 1983 and 1984 programs, they are in the Marine Corps Reserve), can be included in the task force for medical support of the Marines. The vessel corresponds to a 1,000-bed multiprofile hospital in her equipment makeup. Surgery can be performed on 24 patients simultaneously (12 operating rooms, each with 2 tables). Crews keep the hospital ships in a condition of five-day readiness for departure.

Unloading depot ships and receiving airlifted personnel, equipment and cargoes. This phase is characterized by the arrival of MEB forces in the mission area; transfer of prepositioned weapons, military equipment and supplies

to the personnel; and formation of combat-effective units and subunits of the expeditionary brigade. Three phases can be identified here: preliminary preparation; arrival of forward detachments or teams; unloading of depot ships or aircraft, and formation of the MEB.

Preliminary preparation phase. A reconnaissance and communications team of around 60 persons headed by the MEB assistant chief of staff is formed and sent to the landing area by air on receipt of the order for deploying the expeditionary brigade, or before it is received when the area of upcoming combat operations is known. Its missions include gathering and transmitting data to the brigade command element on port capabilities for unloading depot ships, suitability of coastal sectors for the landing, and existing airfields in the deployment area; performing engineer reconnaissance; and preparing proposals for security in the landing area as well as information on local conditions. The team has to cover or prepare proposals on a total of over 100 items.

Depot ship unloading teams of up to 100 persons are established for each ship in the preliminary preparation period. The team is headed by an officer, who is responsible for timely preparation of stockpiled equipment for unloading and for conducting unloading operations. The team consists of the following subunits: ship cargo-handling equipment maintenance; weapon and military equipment demothballing and maintenance; and traffic control of roadstead unloading craft. Unloading teams include both Marines trained for working with equipment as well as personnel from fleet support units and subunits (for working on cranes). An officer aboard the flagship is responsible for overall direction of squadron depot ship unloading. Teams arrive aboard the vessels before they put to sea (which is preferable) or on the sea transit. After completion of unloading the teams disband and the personnel are transferred to airlift cargo processing teams.

Forward detachment (team) arrival phase. Lead elements of the MEB arrive in the operation zone following the reconnaissance and communications team: an MEB headquarters tactical command and control team, a support team for receiving arriving forces, and fleet support subunits.

The MEB headquarters tactical command and control team analyzes data prepared by the reconnaissance and communications team and organizes and monitors measures being taken for full-scale deployment of the Marine expeditionary forces.

The following may be the most important tasks which must be accomplished before the expeditionary brigade main body begins to arrive: formation of a support team for receiving MEB forces and teams for unloading the vessels or aircraft; organization of communications with the higher command element and with subordinate units and subunits; creation of a security zone taking in depot ship or aircraft unloading areas; construction of temporary airstrips and additional outfitting of permanent airfields in the area; organization of unloading zones; organization of medical and other kinds of services for arriving personnel (laundry, bath, aid stations and so on); terrain mapping; and creation of a transport traffic control service.

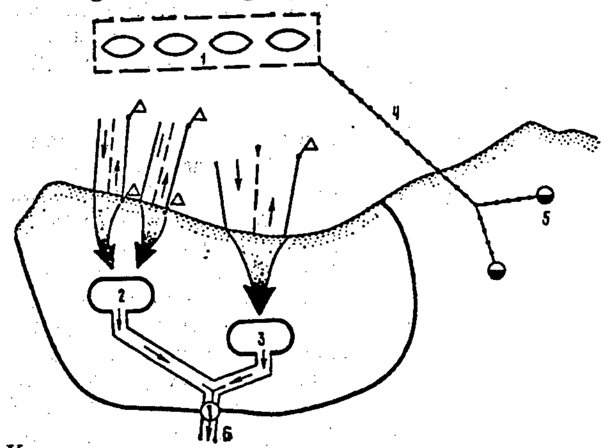
The support team for receiving arriving forces is a temporary subunit (basically formed from the brigade logistic services team as well as from subunits of the regimental assault element and composite air team). It organizes the reception of arriving depot ships or aircraft and the unloading, processing and delivery of cargoes to zones where MEB units and subunits form. A logistic support center is established under the team to coordinate the work of forces and assets assigned for receiving the expeditionary brigade. The team consists of subunits which can be divided into three parts according to the nature of missions accomplished: receiving cargo from depot ships; receiving airlifted personnel and property; and organizing all kinds of logistic support to airlifted expeditionary forces (engineer, logistic, transportation, medical, airfield technical, and so on), the repair of weapons and military equipment if necessary, guarding of the security zone, as well as delivery of weapons, equipment and logistic items to zones where the regimental assault element, composite air team, and brigade logistic services team form and to the expeditionary brigade logistic support zone.

Depot ship (aircraft) unloading and MEB formation phase. The work of unloading vessels begins when then anchor (Fig. 3). According to standards adopted in the United States, five days are set aside for completely unloading a vessel over the beach, or three days for unloading in port. The unloading can be done with a wind velocity up to 25 m/sec, a wave height up to 1.5 m and current speed to 3 knots. Anchorage points can be up to 3 km from the coastline. This is determined by the length of rubberized fabric pipelines on the vessel: two 150-mm lines, each 1,524 m (5,000 feet) long, for transferring fuel ashore and one 100-mm line 3,048 m long for transferring water. Fuel pipelines can be connected if necessary.

A shore team for delivering cargo ashore is formed from personnel of fleet support subunits to unload depot ships. It includes beach commander subunits, landing craft subunits, as well as an amphibious construction battalion. The beach commander subunit organizes and monitors the movement of landing craft and of self-propelled and nonself-propelled pontoons (Fig. 4 [figure not reproduced])) from vessels to shore and back, and organizes and monitors order and safety during their movement and unloading. Landing craft subunit personnel attend to "LCM-8"-Class landing craft. Amphibious construction battalion missions include maintaining self-propelled and nonself-propelled pontoons and small depot ship tugs, laying pipelines from vessels to fuel or water storage facilities on shore, removing natural obstacles in unloading areas, and constructing a temporary camp for shore unloading teams.

Exercise experience showed that one interconnected fuel pipeline can be deployed in eight hours from the moment the ship anchors. It takes some 48 hours to lay

Fig. 3. Unloading depot ships over the beach



Key:
1. Depot ship anchorage
2. Containerized cargo stockpiling area
3. Heavy weapons, military equipment and unpackaged cargo stockpiling area
4. Pipeline
5. POL storage facility
6. Checkpoint

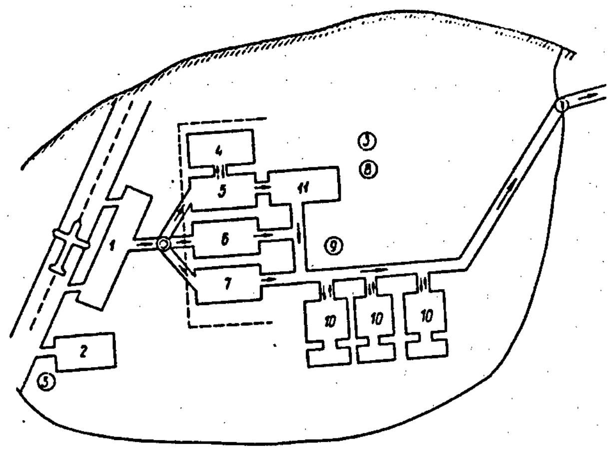
four pipelines for fuel and two for water supply (a typical set for a four-ship squadron). The Marine Corps command believes that this will be sufficient time to construct shore storage facilities. The remaining three days are set aside for filling them with fuel and water. Every ship has three cargo pumps for supplying three kinds of fuel or water ashore. It takes no more than 48 hours to empty fuel and water from all vessel tanks.

Weapons, military equipment and other containerized cargoes are delivered ashore using "LCM-8"-Class landing craft as well as self-propelled and nonself-propelled pontoons (principal dimensions of the latter are a length of 82.3 m, a beam of 19.2 m and a draft of 4.6 m). Variants for using pontoons include a self-propelled pontoon coupled with one or two nonself-propelled pontoons. In the latter instance such a hookup can take aboard 16 standard containers or up to 270 tons of cargo (Fig. 5 [figure not reproduced]). Pontoon speed is up to 8 knots with a sea state of up to 3.

Weapons, military equipment and supplies unloaded ashore are transferred to Marine subunits of the support team for receiving arriving forces. Heavy weapons, military equipment and unpackaged cargoes are stockpiled in one area and containerized cargoes in another. Cargoes which have arrived are inspected and drivers are briefed in these areas, then arrangements are made to dispatch cargoes to areas where expeditionary brigade units and subunits form and to the MEB logistic support zone.

Reception of airlifted MEB forces (Fig. 6) is organized by the command and control team at the destination airfield. The team nucleus is formed from the brigade logistic support team's landing support company and

Fig. 6. Organizing the reception of personnel, military equipment and cargoes at a destination airfield:



Key:
1. Aircraft unloading area
2. Aircraft parking area
3. POL storage facilities
4. Equipment maintenance area
5. Equipment collection and inspection area
6. Cargo processing area
7. Personnel assembly area
8. Water supply point
9. Aid station
10. Brigade unit and subunit personnel forming-up areas
11. Equipment dispatch area

other MEB subunits. Its primary missions are to supervise arriving personnel and cargoes and if necessary provide all kinds of services for subunits and equipment. A MAC communications and command and control team also functions at the destination airfield. Teams for unloading aircraft are established on the basis of one per aircraft. Their tasks include receiving personnel, unloading equipment and cargoes, and directing them to appropriate areas: personnel assembly area; containerized cargo processing area; and equipment collection, inspection and maintenance area. Depending on their parent MEB units and subunits, personnel are sent after inspection to areas where the regimental assault element, composite air team, as well as the brigade logistic service team form. After necessary processing and inspection, military equipment and logistic items are sent to the expeditionary brigade logistic support area.

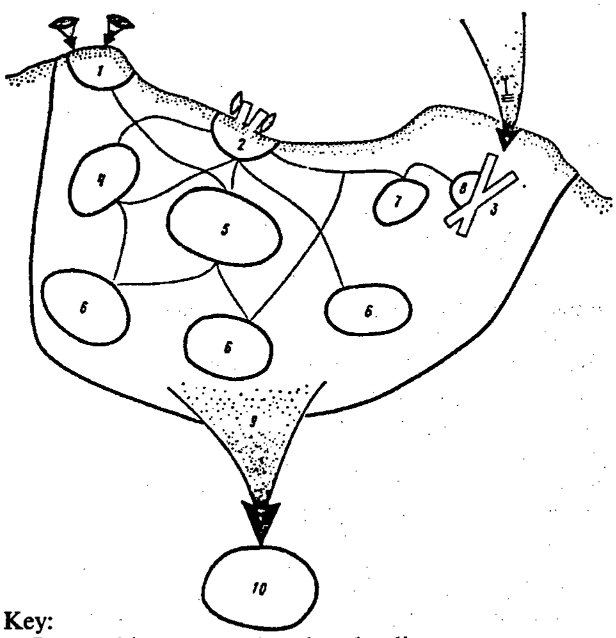
The MEB logistic support area is established before the brigade main body arrives in the area. The following sectors are prepared in there: container and ammunition storage, equipment maintenance, medical service, and POL and water storage. Containers with cargo are marked; conventional symbols on them indicate the vessel where the container was located, the subunit for which it is intended and the nature of contents. Containers in a sector are processed (what, where, to whom and when) by computer. Ammunition arriving in the area is stockpiled in the appropriate sector, where it is

divided by kinds for storage safety, processing, accounting and issue to units and subunits.

Equipment which has arrived is thoroughly inspected and maintained in the logistic support area by personnel of subunits included in the team which supports arriving forces. This work must be completed by the end of the expeditionary brigade main body's movements. Medical service is organized in this area for all MEB personnel. It will be directed chiefly at preventing illness and giving the wounded and victims all kinds of assistance in field hospitals.

A team for traffic control of forces and assets is set up to organize the delivery of personnel, weapons, military equipment and logistic items to areas where basic MEB components form. The team is responsible for detailed coordination of the work of all transportation equipment in the security zone. The team includes transportation subunits, military police detachments, and sections for keeping records on personnel, weapons, military equipment and logistic items which have arrived.

Fig. 7. Forming a combat-effective MEB in a security zone



Key:
1. Depot ship over-the-beach unloading area
2. Depot ship port unloading area
3. Destination airfield
4. Brigade logistic service team forming area
5. MEB logistic support area
6. Regimental assault element forming area
7. Composite air team forming area
8. Personnel, military equipment and cargo reception area
9. Advance of MEB to area of combat operations
10. Attack objective

The MEB begins accomplishing its assigned missions on completion of formation in the security zone (Fig. 7).

Footnotes

1. For beginning of article see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 6, 1989, pp 45-54—Ed.

Antisubmarine Missile Systems

18010885K Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 55-60

[Article by K. Sergeyev]

[Text] Command elements of navies of leading capitalist countries devote considerable attention to developing naval weapons against enemy submarines. Antisubmarine missile systems hold a dominant place among antisubmarine weapons. They include launching equipment (launchers, containers, torpedo tubes), antisubmarine missiles, fire control subsystem gear and auxiliary equipment. Data for launching and guiding antisubmarine missiles usually enter the fire control subsystems from ship sonar systems or sets as well as from other internal and external undersea situation coverage equipment or target designation sources.

Antisubmarine missiles are employed for delivering a warhead to an area where an enemy submarine has been detected. They are ballistic or cruise missiles with a separating warhead in the form of a homing antisubmarine torpedo or nuclear depth charge. After separation and splashdown at the point of aim, the warhead either executes a search and destruction (torpedo) or detonates at a given depth (bomb). Submarines, surface combatants, and antisubmarine airborne vehicles are potential antisubmarine missile platforms. It is possible to employ both fixed and mobile antisubmarine missile systems from shore positions (such as in strait zones). Antisubmarine missiles are launched using various types of launchers.

Foreign navies currently have placed several types of antisubmarine missile systems and antisubmarine missiles in service. In the assessments of western specialists, as ship sonar systems or sets and reconnaissance and target designation equipment are improved and more effective ones are created, this form of weapon will play an even greater role among ASW weapons, which is explained by a number of advantages of antisubmarine missiles compared with other means of destroying enemy submarines. They include delivery of a warhead to the target at high speed, which increases the probability of a target kill, since the enemy submarine has time to go only a slight distance from the place where she was detected; initial functioning of all torpedo subsystems in the immediate vicinity of a target, which contributes to a successful attack; possibility of combat employment essentially under all weather conditions day or night;

short reaction time of systems; and salvo fire, which increases the probability of a target kill.

qThe ASROC (USA), Ikara (joint development of Australia and the British firm of British Aerospace), and Malafon (France) antisubmarine missile systems equipped with antisubmarine missiles of the same name now are in the inventory of navies of various countries. The SUBROC antisubmarine missile system is used aboard U.S. Navy submarines. Performance characteristics of antisubmarine missiles are given in the table.

Basic Performance Characteristics of Antisubmarine Missiles

	United States				Great Britain, Australia		France	
Characteristics	ASROC (1961)	ASROC-VLS (1990)	SUBROC (1965)	Sea Lance (1992)	Ikara (1963)	Super Ikara (1990's)	Malafon (1965)	Milas (1993)
Launch weight, kg	435	750	1,850	1,046	294	715	1,480	800
Dimensions, m:								
Length (overall)	4.6	5.08	5.95	6.1	3.43	4.45	6.15	6.0
Airframe diameter	0.325	0.358	0.533	0.533	0.61	0.57	0.65	0.46
Wingspan	0.76	.	1.0	.	1.52	1.58	3.3	1.35
Range, km:								
Maximum (effective)	9	Around 30	55	160-180	15	110	13	55-65
Minimum	1.5-2	.	.	.	.	.	2	5
Speed, m/sec	426	Supersonic	Supersonic	Supersonic	200	Subsonic	1 40	270
Control system	Program	Inertial	Inertial	Inertial	Radio command	Inertial, remote	Radio command	Inertial, remote
Main platforms	Surface combatants	Surface combatants	Submarines	Submarines, surface combatants	Surface combatants	Surface combatants	Surface combatants	Surface combatants

The **ASROC** antisubmarine missile system has been in the U.S. Navy inventory since 1961. It is installed in almost 300 surface combatants of the U.S. Navy and navies of a number of other countries (Brazil, Canada, the FRG, Italy, Japan, Greece, Pakistan, South Korea, Spain, Turkey and Taiwan). Over 20,000 missiles of this type have been produced as of the present time.

The ASROC antisubmarine missile (see color insert [color insert not reproduced]) consists of a warhead and solid-propellant rocket motor situated in tandem behind it, connected by an adapter which contains time relays controlling shut-down and separation of the engine compartment, and a brake parachute. For in-flight stabilization the antisubmarine missile is supplied with stabilizers located in the rocket motor tail section and on the adapter. A small antisubmarine torpedo (Mk 46 or equivalent) as well as a Mk 17 nuclear depth charge can be used as the warhead. It should be noted that creation of an improved variant of this missile (ASROC-VLS) for launch from Mk 41 vertical launchers is concluding (Fig. 1 [figure not reproduced]).

The missile flies a ballistic trajectory after launch. Range is limited, since the antisubmarine missile is self-contained and its trajectory is not corrected from the platform after launch. Range is determined by the sustainer motor's solid-propellant charge burn time, which is entered in the time relay before launch. The sustainer motor separates at a calculated point on the trajectory and a parachute opens, supporting warhead deceleration and splashdown. The parachute separates and the torpedo motor starts on entering the water. A torpedo begins a target search, while a depth charge detonates at a given depth.

The system uses AN/SQS-23, -53 and -56 shipboard sonars as detection and target designation equipment. Based on information received from them, the Mk 111 fire control system produces firing data. Fire can be conducted with one missile or with a salvo of 2-8 missiles, which are in a combat-ready condition in Mk 10, Mk 20, Mk 26 and Mk 112 launchers.

The **SUBROC** antisubmarine guided missile (Fig. 2 [figure not reproduced]) entered service with U.S. Navy nuclear submarines in 1965 and now the overwhelming majority of American multipurpose submarines are equipped with such antisubmarine missiles. Work of modernizing the antisubmarine missile's motors was conducted during 1977-1981, which permitted extending these missiles' life cycle for another 15 years. In addition, work conducted since 1983 to replace and modernize individual SUBROC antisubmarine missile units and subsystems permitted upgrading some 76 percent of the missile assemblies.

The SUBROC antisubmarine missile consists of a warhead (nuclear depth charge) and solid propellant rocket motor connected by an adapter. In-flight missile stabilization is provided by four T-shaped stabilizers mounted in the nuclear depth charge tail section and by four in the rocket motor tail section. Nozzle devices providing

reverse thrust during warhead separation are contained in the front section of the motor case. The motor is equipped with four nozzles with gas deflectors. During storage the missile's nozzle section is covered by an airtight cover which is thrown off by the gas jet when the rocket motor is started. The antisubmarine missile is equipped with a control system to which the flight mission is input before launch. Missile control in the boost phase is by deflectors which respond to signals from the inertial navigation subsystem.

After being fired from a torpedo tube the motor starts at a safe distance from the submarine, the bottom cover is released, and the missile performs controlled movement in the underwater sector of its path. After emerging from the water it flies at supersonic speed to the given area. On command from the onboard control system the reversible rocket motor ignites at a calculated point on the trajectory, providing for warhead separation from the missile. The nuclear depth charge continues to fly a ballistic trajectory and is kept on it with the help of aerodynamic stabilizers. After entering the water it detonates at a preset depth. According to western press data, the radius of submarine destruction with a 1 to 5 KT charge is 5-8 km. At the present time the Sea Lance antisubmarine missile is being created in place of the SUBROC missile, which is becoming obsolete.

Detection of an enemy submarine and production of firing data are supported by the submarine's automated combat control system, which permits launching an attack against several targets both with SUBROC antisubmarine missiles and with torpedoes. A conventional 533-mm torpedo tube is used for firing.

Creation of the versatile **Sea Lance** supersonic long range antisubmarine missile has been going on since 1980. The final stage of development work is concluding at the present time. Boeing was chosen as the prime contractor (a contract for the sum of $380 million was signed with it in the summer of 1986). The firms of Gould, Hercules Aerospace, Litton, and Honeywell are participating in this project as subcontractors. The decision has been made that the new missile will be equipped with the Mk 50 small advanced antisubmarine torpedo. In addition, it is planned to use a nuclear depth charge as the warhead. It is expected that the Sea Lance missile will become operational with the U.S. Navy with a conventional warhead in 1992. It is proposed to equip "Sturgeon"-Class, "Los Angeles"-Class and "Seawolf"-Class multipurpose submarines with it. The possibility of accommodating this missile aboard surface combatants also is not precluded.

The Sea Lance antisubmarine missile (Fig. 3. [figure not reproduced]) consists of a warhead and solid propellant rocket motor connected by an adapter containing an onboard control system and a parachute for warhead deceleration and splashdown. The antisubmarine missile tail section contains a folding fin assembly which stabilizes the missile in flight. The motor case is made of kevlar. The antisubmarine missile is contained in a sealed capsule made of composite materials. It is fastened and centered in the capsule using graphite-epoxy inserts and impact-absorbing inserts. Use of the capsule precludes the missile from coming in contact with the water medium and permits lightening its construction.

The capsule provides for storage, transportation and maintenance of the antisubmarine missile and its loading in the torpedo tube. It is capable of withstanding high pressure during a missile launch from considerable depths (to 80 percent of the operating depth of modern U.S. Navy SSN's). The capsule with missile rises to the water's surface because of positive buoyancy without using any additional controls. Such a technical solution provided a saving of useful space, which is very limited, and also essentially nullified revealing acoustic noises and energy expenditure with free ascent. This should give submarines equipped with this weapon considerable advantages compared with those on which SUBROC antisubmarine missiles are installed.

After being fired from a torpedo tube, the capsule with missile rises to the water's surface. This is registered by a special sensor, and at a signal from the sensor the capsule nose fairing separates and the rocket sustainer motor starts, supporting flight at supersonic speed along a ballistic curve in the air sector of the trajectory. The missile is controlled by an onboard control system. Gas control-vanes operating at its command correct the antisubmarine missile's flight trajectory in the boost phase. Warhead separation from the motor occurs at a calculated point. The small antisubmarine torpedo descends on parachute, enters the water, and searches for and destroys the target. The antisubmarine missile's range does not exceed the first convergence zone with the Mk 50 torpedo used as a warhead.

When fired from an SSN, target designation is provided by the sonar system's passive channel. On detecting an enemy submarine the SSN's automated combat control system produces data on the target and transmits them to the onboard missile control system. After the antisubmarine missile is fired from a torpedo tube there is no further updating of target data and the missile is completely autonomous in flight. Mk 41 vertical launchers and Mk 143 armored launchers can be used for firing the missile from surface combatants.

Surface combatants of navies of Great Britain, Australia and Brazil are equipped with **Ikara** antisubmarine missiles for ASW. The missile, which is an airborne vehicle with ventral accommodation of a small antisubmarine torpedo, is launched by a specially developed dual-mode solid propellant rocket motor. It provides acceleration and flight at a low altitude (to 300 m) at subsonic speed. The ship automated combat control system continuously produces new current data on the location of the firing ship, the antisubmarine missile (Fig. 4 [figure not reproduced]) and the target and, based on this data, produces a command for correcting the missile's flight path. Immediately after launch the antisubmarine missile is

tracked by a servosystem, which transmits control signals to an onboard transceiver. Onboard control system commands are executed by elevons located on the trailing edge of the wing. Flight altitude is monitored by an aneroid altimeter connected to the missile control system circuit. Small stabilizers mounted in the missile tail section and a spoiler at the end of the missile motor nozzle are used to ensure in-flight stability. A thermal battery supports operation of onboard systems.

Pyrotechnic cartridges which separate the torpedo from the missile are triggered on approaching the target location. The torpedo splashes down on a parachute, which separates at the moment of splashdown, and then the torpedo motor starts. After this the missile continues flight with the motor operating. Interference which arises when the missile falls into the water and which can hinder the torpedo homing system is precluded by diverting the missile away from the torpedo splashdown point. Mk 44 and Mk 46 (USA), Type 42 (Sweden), types A244 and 244/S (Italy), and Stingray (Great Britain) small antisubmarine torpedoes can be used as warheads for Ikara antisubmarine missiles, but only American models are being used at the present time.

Firing data produced by the shipboard automated combat control system based on data received either from a shipboard sonar or from other target designation sources are taken into account when firing these missiles. Contact with the target is not mandatory for the firing ship. Before firing, the missile is fed from an underdeck magazine to a special launcher, which provides horizontal rotation and the necessary elevation for firing in a given direction.

Western specialists consider this missile one of the most advanced. Before sonars with long towed arrays appeared aboard ships, the Ikara's potential capabilities were not being used to the full extent since its range usually exceeded sonar range. This antisubmarine missile system can be employed independently of weather conditions. Its shortcomings include heavy weight and large dimensions. A modernization of ship equipment permitted improving these parameters appreciably. While previously 13 units (each weighing over 200 kg) were used aboard ship to control the system, presently only three belowdeck modules are necessary for this. In addition, the Ikara's servosystem has been upgraded.

According to foreign press announcements, work presently is under way to create an advanced antisubmarine missile system, the Super Ikara, in which those same partners which developed the Ikara system are participating. The new development generated great interest in navy representatives. Considering the fact that not only surface combatants, but also shore batteries will be outfitted with this system, foreign specialists believe that it may be of interest for the navies not only of Great Britain and Australia, but also of Japan, Sweden and Spain as well as other countries.

Work being done on the advanced antisubmarine missile system is aimed at reducing its weight-size characteristics and improving basic performance data. It can be installed even aboard small ships and small surface craft and is controlled by one person from a small console.

The Super Ikara missile (Fig. 5 [figure not reproduced]) with folded wing panels is stored in a sealed container accommodated on the ship's deck. The wing panels open after launch by a solid propellant booster rocket and after the missile emerges from the container. Reaction time of the new system has dropped to 15-30 seconds, and a missile salvo can be fired, which favorably distinguishes it from the old antisubmarine missile system (the Ikara).

The design configuration of the new subsonic, remotely controlled antisubmarine missile largely is the very same as for the Ikara, but it is proposed to use a turbojet motor on it as a sustainer motor, which will provide an appreciable increase in the missile's range. It is controlled by an inertial navigation system and can be guided not only from the firing ship, but also from surface or airborne remote control points. British Aerospace representatives believe that the new missile will have the capability of loitering in the target search area until the moment target coordinates are updated. Remote control can be exercised from LAMPS system helicopters. It is also proposed to improve combat capabilities of the new antisubmarine missile system by using the most modern and advanced small antisubmarine torpedoes.

An antisubmarine system equipped with the **Malafon** antisubmarine missile has been in service with the French Navy since the early 1960's. It did not become widespread and presently only nine destroyers of various classes are equipped with it.

Firing data are produced by a shipboard automated combat control system based on data received from a sonar. An inclined ramp launcher accommodated on the ship deck is used for launching the Malafon missile (Fig. 6 [figure not reproduced]). The antisubmarine missile is an airframe with swept [sic] wing and tail unit. It is launched using two ventral solid propellant booster rockets which separate from the missile after acceleration to a high subsonic speed. Subsequently the missile glides. After the missile is launched a trajectory correction is made based on incoming current target data. Control commands for the correction are transmitted to the missile over a radio channel and, in response to autopilot signals, are executed by elevons which automatically deflect to provide the requisite lift as the missile's flight speed drops, while flight altitude is controlled by a radio altimeter. When the airframe is in a given area the antisubmarine torpedo separates from it. A parachute stowed in a tail cone opens and the torpedo descends to the water, where it searches for and destroys the target.

In the opinion of western specialists, the Malafon's low flight speed is compensated by the capability of making a flight path correction, but range is not great and does not meet modern requirements. In addition, the system

is rather cumbersome. It is proposed to overcome all these shortcomings during creation of a new antisubmarine system being equipped with the remotely controlled **Milas** antisubmarine missile. It is being developed by the firms of Matra and OTO Melara and is to become serviceable with the French and Italian navies in 1993. The Otomat antiship missile system created by these firms became the basis for the new antisubmarine missile system. Range is determined by capabilities of the ship sonar to provide target designation and presently is limited to the first convergence zone. In addition, it is possible to issue target designation from remote control points (aircraft, helicopters, ships) as well as to correct the antisubmarine missile's flight path based on current target data. It is proposed to use the very same standard equipment to launch this missile as for launching the Otomat antiship missile.

The new Milas antisubmarine missile (Fig. 7 [figure not reproduced]) will use a motor compartment from the Otomat missile with Arbizon turbojet motors, and a small antisubmarine torpedo (the Murene or A244/S) in place of modules with warhead and homing head. The remotely controlled Milas missile is capable of cruising flight at a height of 20 m and a speed of around 270 m/sec to a distance up to 100 km. As submarine detection equipment improves this missile's range can be increased to the second and third convergence zones.

Among the shortcomings of existing antisubmarine missiles (ASROC, SUBROC, Ikara, Malafon), specialists of navies of capitalist states include the limited capability for accommodating missiles aboard ship, high cost, and considerable weight of launchers designed to launch only one missile (for antisubmarine missiles of the last two types). Work presently is under way aimed at increasing range, improving accuracy of placing missiles in the area where a target submarine is located, and increasing the capabilities of power plants and torpedo homing systems.

MILITARY ECONOMICS, INFRASTRUCTURE

Japan's Airfield Network

18010885L Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 67-73

[Article by Col V. Samsonov]

[Text] Practical measures being taken by the Japanese leadership in the sphere of military organizational development in the 1980's clearly attest to the dangerous trends in its militaristic course, which envisages active participation in the American strategy of global confrontation with the USSR and creates a threat to peace and security in the Asiatic-Pacific region.

A program for Armed Forces organizational development for 1986-1990 presently is being implemented in Japan. It sets aside a special place for increasing the striking and offensive capabilities of all branches of the Armed Forces. The Japanese government plans to spend over ¥18 trillion (around $120 billion) to implement this program, which is 1.5 times more than the volume of military expenditures for the previous five years.

Significant sums are being appropriated for improving the country's military infrastructure, particularly for constructing and renovating airfields and air bases, carrying out measures to improve their survivability, establishing POL and ammunition depots, and upgrading communications and command and control systems. According to an estimate by American specialists, realization of this program will bring the Japanese Armed Forces very close in combat capabilities to a level ensuring fulfillment of obligations undertaken by the country under the Japanese-American "Security Treaty" which provide for a reliable blockade of strait zones, creation of an insurmountable air defense zone in the vicinity of the Japanese Archipelago, and defense of ocean lines of communication at a distance up to 1,000 nm from the Japanese Islands. This means one more step will be taken along the path of implementing the concept advanced by Prime Minister Nakasone back in 1983 of turning Japan into an "unsinkable aircraft carrier." Its essence lies in acquiring the capability to accomplish the above missions to the full extent with national armed forces.

According to data of an aeronavigation information reference ("Asia, Australasia and Pacific Supplement, British Airways, 1986"), Japan's airfield network includes 120 airfields with an artificial runway surface. Their distribution by runway length is shown below.

Runway Length, m:	Number of Airfields
3,000 or more	12
2,500-3,000	14
1,800-2,500	28
1,200-1,800	38
Less than 1,200	28

Of the total number of airfields, 54 with runways longer than 1,800 m are suitable for basing modern combat aircraft of fighter aviation, and 26 of them have concrete runways of 2,500 m or longer. A general description of Japanese airfields with runways of 2,500 m or longer is given in the table. On the whole the operational capacity of the airfield network (54 airfields with runways longer than 1,800 m) with dispersed basing of combat aircraft (one squadron of 20-24 aircraft per airfield) is 1,000-1,300 aircraft.

Basic Characteristics of Airfields with Runways of 2,500 m or Longer on Japanese Territory

	Main Runway					
	Coordinates					
Airfield Name (Used by)	Degrees, Minutes North Latitude	Degrees, Minutes East Longitude	Length x Width, m	Inbound Heading, Degrees	Surface	Main Radionavigation Equipment
Airfields with runways of 3,000 m or longer						
Chitose (AF & CA)	42° 48'	141° 40'	3,000x60	180-360	Asphalt concrete	CL, VOR, TACAN, ILS, ATC
Misawa (Japanese AF and USAF)	40 43	141 23	3,060x45	100-280	Asphalt concrete	Same as above
Yokota (USAF)	35 45	139 21	3,355x60	180-360	Concrete	TACAN, ILS, ATC
Narita (CA)	35 46	140 23	4,000x60	150-340	Concrete	VOR, ILS (2), ATC (3)
Haneda (CA)	35 33	139 46	3,150x60	150-330	Asphalt concrete	CL (2), VOR (2), ILS (2), ATC (2)
Osaka (CA)	34 47	135 27	3,000x60	140-320	Asphalt concrete	CL (2), VOR, ILS, ATC
Kumamoto (CA & Army)	32 50	130 51	3,000x45	70-250	Asphalt concrete	CL, VOR, ILS, ATC
Nagasaki (CA)	32 55	120 55	3,000x60	140-320	Asphalt concrete	CL, VOR, ILS, ATC
Kagoshima (CA)	31 48	130 43	3,000x45	160-340	Asphalt concrete	CL, VORTAC, ILS, ATC
Kadena (USAF)	26 21	127 46	3,690x90	50-320	Asphalt concrete	VORTAC, ILS (2), ATC
Naha (AF & Navy, CA)	26 12	127 39	3,000x45	180-360	Asphalt concrete	CL, VORTAC, ILS, ATC
Shimoji-shima (CA)	24 49	125 09	3,000x60	170-350	Concrete	TACAN, VOR, ATC, ILS
Airfields with 2,500-3,000 m runways						
Obihiro (CA)	42 44	143 13	2,500x45	170-350	Asphalt concrete	CL, VOR, ILS, ATC
Hakodate (CA)	41 46	140 49	2,500x45	120-300	Asphalt concrete	Same as above
Akita (CA)	39 37	140 19	2,500x60	100-280	Asphalt concrete	VOR, ILS, ATC
Matsushima (AF)	38 24	141 13	2,700x45	140-320	Asphalt	CL, TACAN, ILS, ATC
Komatsu (AF & CA)	36 23	136 25	2,700x45	60-240	Concrete	CL, VORTAC, ILS, ATC
Hyakuri (AF)	36 11	140 25	2,700x45	30-210	Concrete	CL, TACAN
Gifu (AF)	35 23	136 52	2,700x45	100-280	Concrete	.
Nagoya (Komaki, CA & AF)	35 15	136 56	2,700x45	160-340	Asphalt concrete	CL, VORTAC, ILS, ATC
Hamamatsu (AF)	34 45	137 42	2,550x60	90-270	Concrete	CL, TACAN, ATC
Fukuoka (CA)	33 35	130 27	2,800x60	160-340	Concrete	CL, VORTAC, ILS, ATC
Oita (CA)	33 29	131 44	2,500x45	10-190	Asphalt concrete	CL, VOR, ILS, ATC
Niutabaru (AF)	32 05	131 27	2,700x45	100-280	Concrete	TACAN, ATC
Futema (USAF)	26 16	127 45	2,745x45	60-240	Asphalt concrete	Same as above
Iwo Jima (Navy & AF)	24 47	141 19	2,655x45	70-250	Asphalt concrete	CL, TACAN

Note.AF—Air Force; CA—Civil aviation; CL—Compass locator; VOR—Theta-theta radionavigation system supporting the homing of aircraft to the airfield and crosscountry flights; TACAN—Short-range radionavigation system; VORTAC—Short-range radionavigation system combining elements of VOR and TACAN systems; ILS—Localizer and glideslope landing system; ATC—Air traffic control radar systems and stations.

Airfields are distributed relatively evenly over the country's territory (Fig. 1). By the nature of their use, they presently are divided into airfields for basing military and civilian aviation. Some of them are used both by military and by civilian aviation—Komatsu, Kumamoto, Nagoya (Komaki), Naha, Chitose.

The majority of airfields with a substantial runway surface are built according to a standard scheme: as a rule, there is one runway, a main taxiway which can be used for take-off and landing if the runway is out of service, group and single flight line parking spaces, ramp areas for alert aircraft, a POL depot, and technical and service buildings. In addition, semiburied or aboveground ammunition depots have been set up at all combat aviation air bases, and five of them—Chitose, Komatsu, Misawa, Niutabaru, and Naha—have reinforced concrete aircraft shelters. A general view and main installations of Komatsu Air Force Base are shown in Fig. 2 [figure not reproduced]).

The ground radionavigation and radio communications equipment deployed at Japanese airfields serves to support military and civilian flights. The equipment consists of radar and navigation stations set up at points with precise topographic tie-in, as well as various compass locators which operate independently or as part of systems. Essentially all airfields with runways 2,500 m long or longer are equipped with modern radionavigation equipment, lights and lighting facilities, and communications equipment permitting flights day or night in VFR or IFR conditions.

Short-range navigation is supported by TACAN (Tactical Air Navigation), VOR (Very High Frequency Omnidirectional Range), VORTAC (Collocated VOR and TACAN Stations) radionavigation systems; air traffic control radar systems and stations; as well as various compass locators (NDB—Nondirectional Radio Beacon) and other equipment. ILS (Instrument Landing System) localizer and glideslope electronic landing systems are installed at all civil airfields with runways of 2,500 m or longer.

The electronic equipment of airfields with runways from 1,800 m to 2,500 m long used by military aircraft usually includes a TACAN system. VOR navigation systems usually are installed at civil airfields. On the whole, the equipment of airfields with 1,800-2,500 m runways also permits supporting flights of military and civilian aircraft day and night in VFR and IFR conditions.

Twenty-two of the 54 airfields with runways over 1,800 m long have been chosen for basing military aircraft in peacetime. The largest air bases include Chitose, Misawa, Hyakuri, Komatsu, Yokota, Niutabaru, Kadena and Naha. U.S. Air Force aircraft use the Misawa, Yokota, Atsugi, Iwakuni, Kadena and Futema air bases. Japanese aircraft of the Air Force, Navy and Army are stationed at 19 air bases, and 3 of them (Misawa, Atsugi and Iwakuni) are used jointly by Japanese and American aircraft.

In realizing the concept of turning Japan into an "unsinkable aircraft carrier," the Japanese leadership is placing very serious emphasis on improving the military aviation basing system and developing the country's airfield network, and it is allocating considerable funds for this. A special place among the set of measures being conducted within this framework is given to improving the military aviation basing system.

For example, after studying the experience of wars and local conflicts of the latter half of this century, Japanese military specialists developed a plan for improving the survivability of air bases and radar stations and began implementing it in 1981. This plan envisages the following basic measures: forming composite surface-to-air missile and antiaircraft battalions for air defense of air bases, radar stations and other Air Force facilities; outfitting airfield technical support units and subunits with equipment for rapid repair of damaged runways (special mats or decking for restoring runways, and other supplies for filling craters), mobile arresting gear for supporting aircraft landings on damaged (shortened) runways, as well as various equipment for fueling and servicing aircraft under field conditions; constructing reinforced concrete shelters for combat aircraft at air bases; and camouflaging air base facilities.

An example of the integrated use of these assets for ensuring survivability of an air base is shown in Fig. 3.

The composite SAM-AAA battalions are for air defense of air bases, radar stations as well as other Air Force facilities against low altitude enemy air strikes. Such battalions include three types of air defense batteries (air base, radar station, and SAM position), which differ from each other in organic weapons. For example, the air base air defense battery has two Type 81 close-range SAM systems, 24 Stinger portable SAM systems and 16 Vulcan towed antiaircraft guns. The radar station air defense battery has two Type 81 SAM systems, 24 Stinger portable SAM systems and six Vulcan antiaircraft guns. The long-range SAM position air defense battery (Nike-J; Patriot in the future) has only Stinger portable SAM systems (24 launchers) and Vulcan antiaircraft guns (6 guns).

The number and type of batteries in each battalion will depend on assigned missions. For example, the 1st Composite SAM-AAA Battalion activated on Hokkaido (headquarters at Chitose) in late 1986 has a battery for air defense of Chitose Air Base, and two radar station air defense batteries (Tobetsu and Wakkani), which have six Type 81 SAM systems, 72 Stinger portable SAM systems, and 38 Vulcan antiaircraft guns. In addition, separate air defense batteries have been activated for Misawa and Komatsu air bases as well as the Ominato radar station air defense battery; subsequently, as new air defense batteries are formed, it is planned to include them in corresponding battalions.

It is planned to create a total of six composite SAM-AAA battalions in the course of implementing the program for organizational development of the Japanese Armed Forces. They will provide cover for the main air bases on

Fig. 1. Main airfields on Japanese territory

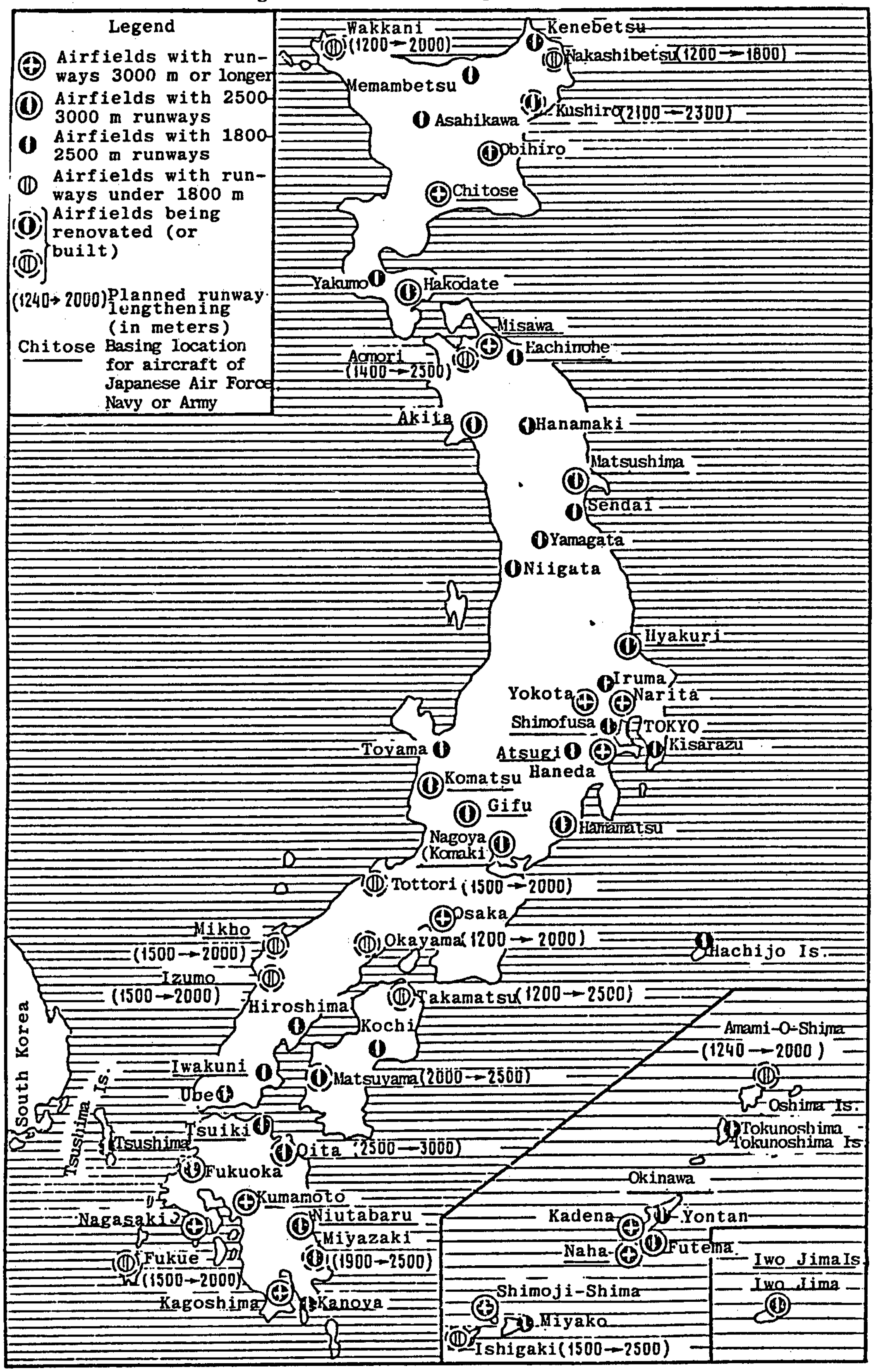
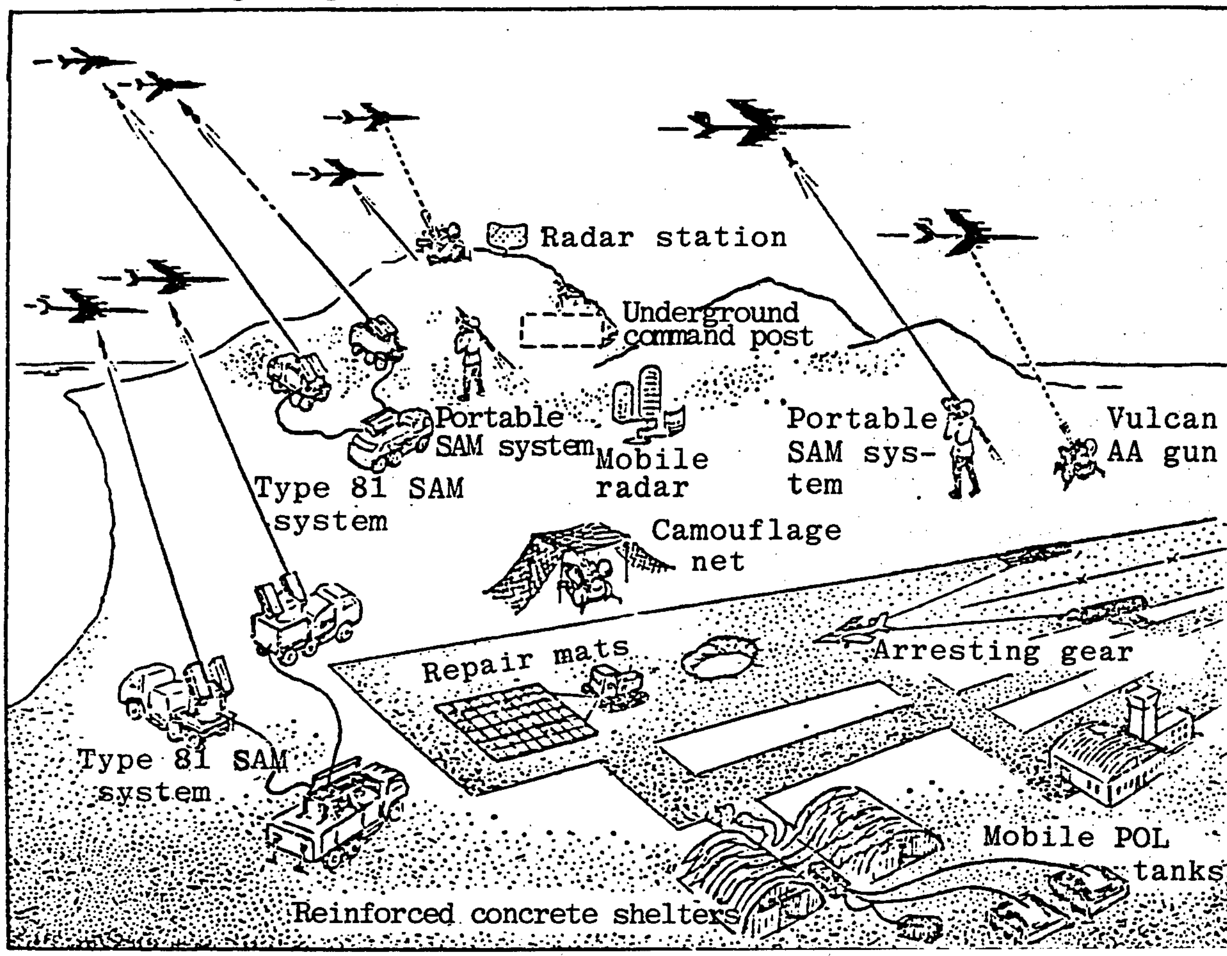


Fig. 3. Diagram of the use of various assets for improving air base survivability



Hokkaido, Honshu and Kyushu islands as well as cover for radar stations and other Air Force facilities against low-altitude enemy air strikes.

Air base survivability largely is determined by the capability of air field technical support units to restore runways in short time periods as well as to support the landing of combat aircraft on damaged (shortened) runways. To restore damaged runways Japanese specialists have developed special repair mats (decking) for filling craters formed from the explosions of bombs, missiles and other weapons; these mats are being delivered to Air Force and Navy air units. A repair mat is approximately 20x30 m in size and is towed to the runway damage site by tractor or other means of transportation. As of April 1988 airfield technical support units had received 90 repair mats, of which 70 are for Air Force air bases and 20 for Navy air bases; by April 1989 it was planned to deliver another ten mats (seven for the Air Force and three for the Navy).

Special mobile arresting gear has been developed to support landings on explosion-damaged (shortened) runways; the gear snags an aircraft hook lowered by the pilot and decelerates an aircraft that has landed in approximately the same manner as an aircraft carrier arresting cable. Because of this the aircraft's landing run is shortened severalfold, which provides an opportunity to use runway sectors not damaged by explosions for a landing. Tests of experimental arresting gear were conducted in 1979.

One set of arresting gear has been delivered to the Armed Forces annually beginning in 1981.

Construction of standard reinforced concrete shelters for combat aircraft also began in 1981. At the present time 41 shelters (Fig. 4 [figure not reproduced]) have been built at Japanese air bases, including 22 at Chitose, 6 at Komatsu, 5 at Misawa, 4 at Niutabaru, and 4 at Naha air bases. Of these, eight are for alert aircraft, five for E-2C Hawkeye aircraft and the rest for single combat aircraft. Only one squadron at Chitose Air Base is fully supported with reinforced concrete shelters. Construction of standard reinforced concrete shelters continues. It is planned to bring their overall number at Japanese air bases to 90 by the end of 1990 in accordance with the program.

In addition to the above measures, various facilities have been camouflaged at Japanese air bases using camouflage nets and camouflage painting as well as using the terrain's natural concealing features.

Renovation of existing air bases and construction of new air bases is one of the most important directions for upgrading Japan's military aircraft basing system. Such major Air Force bases as Chitose, Misawa and Komatsu, the Hachinohe Naval Air Base and others have been renovated in just the last three years under plans of the Japan Defense Agency. A second runway (3,000x60 m), 12 reinforced concrete shelters for combat aircraft and a number of airfield technical installations were built at Chitose Air Base during renovation. Considerable work was done to equip Misawa Air Base additionally in connection with the stationing of the U.S. Air Force 432d Tactical Fighter Wing there (some 50 F-16 aircraft). In particular, the number of group parking areas was increased and POL and ammunition depots, aircraft shelters and administrative-technical buildings were built.

Construction of a new Air Force and Navy air base on Iwo Jima (2,655x45 m runway), situated more than 1,000 km south of Tokyo, was completed in 1987. Foreign military specialists evaluate creation of the air base on Iwo Jima as an important step in support of accomplishing the mission of defending ocean lines of communication at a distance of up to 1,000 nm from the Japanese Islands, particularly in providing air defense of these LOC. Air Force and naval aircraft are actively mastering that air base. A special zone (its total area is around 275,000 km_2) has been established near Iwo Jima for aircraft to practice combat missions; it is the largest in size of all 23 Air Force and Navy combat training zones existing today.

Civil aviation airfields are being additionally outfitted on an ever-growing scale. For example, according to announcements of the Japanese information bulletin KOKU TSUSHIN (AIR HERALD), it is planned to renovate more than 20 such airfields in the period 1985-1995, during which primary emphasis is being placed on runway lengthening. Runway length will be increased to 1,800 m or more (see Fig. 1) at 11 of the above 20 airfields. Civil aviation airfields continue to be outfitted with more modern radionavigation, control, and communications equipment as well as with equipment for airfield technical support to flights.

REPORTS, EVENTS, FACTS

Militaristic Propaganda in Japanese Printed Publications

18010885M Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 75-76

[Article by Col (Ret) I. Moskvin]

[Text] Japan's propaganda machine which preaches militarism is accelerating, with an important role given to the military press, including such publications as "Boei hakusyo" [White Book on Defense][1], "Boei nenkan" [Defense Yearbook], "Jietai nenkan" [Japanese Self Defense Forces Yearbook], "Sobi nenkan" [Armament Yearbook], the digest "Gunji kenkyu" [Military Research in Japan] and so on.

The military-theoretical journal KOKUBO [NATIONAL DEFENSE], published by the Asagumo Shimbunsya Publishing House since August 1953, should be noted in particular in the overall mass of military periodicals. Militaristically minded representatives of the ruling circles and the press appear in the journal in addition to the Japanese Defense Agency. This is shown by such publications as the article "USSR Navy Submarines are a Real Threat in the Far East," a special interview of a representative of the Komeito party leadership by an analyst of the newspaper ASAHI about new legislation for the Self Defense Forces in case of "extraordinary circumstances," and similar materials.

Statements by some political figures about the "possibility of acquiring nuclear weapons" are ending up in KOKUBO more and more often (in a veiled form). Its pages devote much space to a substantiation of claims to Soviet territories and to Japan's rebirth as a "great military power."

Advertising of military-historic works published in Japan occupies an important place in the journal. The 102-volume "Daitoa senso sensi" [History of War for Great East Asia] prepared by the Japanese Defense Agency Research Institute is chiefly popularized. It praises the "exploits" of the Kamikazes in every way. In addition, the "Boei handobukku" [Armed Forces Pocket Reference] put out by the Asagumo Shimbunsya Publishing House is advertised regularly. Articles and paragraphs published in these books implement ideas about the need to strengthen Japanese-American presence in the Western Pacific on an antisoviet basis, including to retain the U.S. Armed Forces grouping in South Korea and revise Japan's military legislation and its accelerated militarization.

The "need" for realizing militaristic ideas is motivated by the "military threat" allegedly stemming from the Soviet Union. As Japanese specialists note, propaganda efforts aimed against the USSR in combination with various methods for brainwashing the population and Self Defense Forces personnel often achieve their objectives.

But despite the militarists' propaganda tricks, the antiwar movement is noticeably expanding in Japan and in its Armed Forces of late, and pacifist sentiments and dissatisfaction with the military-political leadership's power politics are growing.

Footnotes

1. For more details see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 12, 1988, p 16—Ed.

New SSBN Crew Training Complex

18010885N Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) p 76

[Article by Col N. Sterkin]

[Text] Among other tasks, the decision by the UK military-political leadership in 1982 on building four "Vanguard"-Class SSBN's and placing them in service with the Royal Navy by the mid-1990's also advanced the task of training for their crews.

To this end a new training building, the first phase of a future training complex being created under the Trident program, was transferred to the Navy in March 1989.

The five-story reinforced concrete building costing £7.7 million ($13.5 million) was built by the firm of Alfred MacAlpin on the grounds of the existing SSBN crew training complex at Faslane Naval Base (approximately 30 km northwest of Glasgow, Scotland). A modern Ferranti Computer Systems TACTICAN integrated simulator was accommodated in the existing complex in 1986, permitting training in handling "Resolution"-Class SSBN's under various conditions with the introduction of complicating tactical situation elements. Seven sonars of types 2001, 2007, 2009, 2030, 2035, 2047 and 2057 and other equipment have been installed as its subsystems for operator training.

Twelve auditoriums for conducting theoretical classes, rooms for working on practical skills, and offices for instructors and the administration are provided in the new training building. One of the basic training equipment components will be a full-size launcher with a Trident II (D-5) missile and SSBN missile fire control system stations and assemblies. In addition, various simulators are being installed there for training teams of the control center, of other control stations and of battle stations of the ship. The outfitting of training classrooms will permit "Vanguard"-Class SSBN crew members to learn the equipment and work on practical actions to the full extent of the missile firing program.

Royal Navy instructors selected for the new training complex will undergo on-the-job training in the United States during 1989. Work of the second and third center expansion phases is to be completed in early 1990, and it is planned to begin training there at that time.

Under the Trident program it is planned to carry out construction amounting to £660 million at Faslane Naval Base and at Coulport Missile Arsenal (13 km from the naval base). In addition to the training building, warehouse spaces costing £5.2 million recently were built at Faslane under this program.

U.S. Navy Medical Service Reorganization

18010885O Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 76-77

[Article by Capt 1st Rank L. Lyudov]

[Text] In recent years the U.S. Navy leadership has been showing serious concern over the status of the medical service. American experts explain this situation as a shortage of medical personnel, with one of the reasons being a drop in prestige of the medical service in the Navy, especially aboard ship; the lowered level of qualification of medical personnel; and the increased amount of work for massive examination of naval personnel for use of alcohol and drugs and in connection with the need to identify patients and carriers of the AIDS pathogen.

In November 1988 the U.S. Navy command decided to reorganize the medical service to solve these problems. It is planned to create two new commands, the Atlantic and Pacific fleet medical commands, on the basis of the six existing territorial medical commands. As a result of this reorganization, questions of the status of naval medical service combat readiness will be constantly in the field of view of the commanders in chief of these fleets, to whom they will be directly subordinate. This will permit prompter accomplishment of tasks connected with medical service combat readiness.

Medical personnel freed up as a result of the disbanding of territorial commands are to be sent to fleet medical establishments. In addition, it is proposed to bring in more than 1,000 additional servicemen and civilians to augment the medical personnel of hospitals and other medical establishments, triple the recruitment to medical faculties of educational institutions, increase the time of professional training of military physicians and middle medical personnel, increase salaries, introduce additional pay increments and privileges for all categories of medical personnel, raise the effectiveness of medical examinations through use of the latest equipment and advanced diagnostic methods, and improve the quality of medical support for servicemen's families.

It is planned to allocate $40 million in fiscal year 1989, $60 million in FY 1990 and $75 million in FY 1991 to accomplish all these measures, figured to take three years.

According to estimates by military medical personnel, implementation of the planned measures along with present realization of the program for expanding hospital facilities will permit a significant increase in effectiveness of medical support for the U.S. Navy.

FRG Navy Diver Training

18010885P Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) p 77

[Article by Capt 2d Rank M. Shnurkov]

[Text] The FRG Navy command is devoting considerable attention to training divers to work under conditions of low temperatures. A special four-week course (up to 50 trainees) has been organized for this purpose; several sessions are held annually in the winter months (beginning in January), primarily in Norway. Persons who have gone through basic diver training (including a "dive" to 50 m in a pressure chamber) and who have certain underwater work skills such as placing rivets and patching a hole are accepted for the courses. Divers who have served in naval shore subunits often are included among the trainees so that they can gain seamanship practice.

Divers arrive at the Haakonsvern Naval Base in southern Norway aboard two seagoing tugs, the "Juist" and "Baltrum," equipped for diving work. The group also includes 15 instructors and a physician. An FRG naval liaison officer permanently stationed at Haakonsvern coordinates with Norwegian authorities.

Training dives last for three weeks, with training tasks of increasing difficulty performed. West German divers spend the first week right at the naval base, where they make dives down to 11 m. Water temperature averages around 5°C. One feature of this area is the water's high transparency (considerably greater than in FRG coastal waters).

During the second week acquired skills are reinforced by making dives in fjords at ship anchorages with an increase in maximum diving depth to 15 m. In this period trainees practice the methodology of simple underwater work using a chisel and saw on wood and metal. These operations are performed at a depth of 6 m on a specially lowered workbench.

The third week is devoted to practicing night dives, the depth of which constantly increases to the maximum permitted by standards for ship engineering department divers who have gone through a full training course.

The final training phase (fourth week) takes place in the FRG, where a two-day practical class for the record is held at Kiel Naval Base on the subject "Inspecting the Underwater Body of a Ship Hull at Night" (a team of six divers is assigned to a destroyer), and the final three days are for practice dives at the Neustadt basing facility.

New Japanese Earth Resources Reconnaissance Satellite

18010885Q Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 77-78

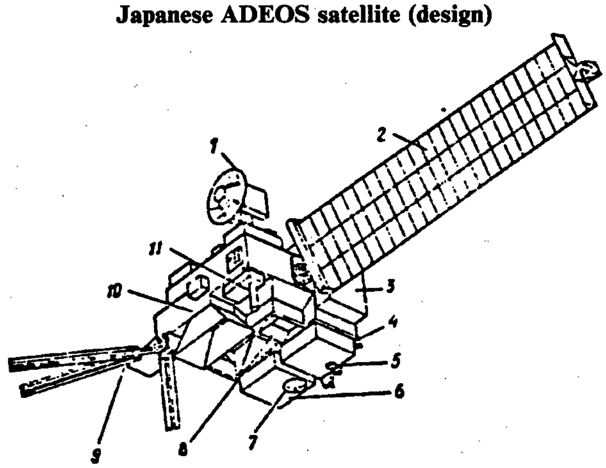
[Article by L. Romanenko]

[Text] According to foreign press announcements, evaluation of a conceptual design of the ADEOS satellite, which will be developed on the basis of Japanese technology (see figure), was completed in 1988. A feature of the new satellite is considered to be the modularity of design and the possibility of changing orbit, performing orbital refueling and replacing measurement instrumentation units. This satellite will be an intermediate system between the so-called first generation (MOS and ERS series) earth resources reconnaissance satellites and future platforms placed in polar orbits. The launch of ADEOS using an H-2 booster rocket is planned for 1994. Tentative program cost is $483 million.

The ADEOS (weight in orbit around 2.5 tons) is to be inserted in a synchronous solar orbit 800 km high with an inclination of 98.6° and period of rotation of 100.92 minutes. Japanese specialists estimate that its active lifetime will be three years with a 3.5 kw output of solar batteries.

It is planned to install the AVNIR (Advanced Visible and Near Infrared Radiometer) on the satellite to obtain images in the infrared and visible regions of the spectrum, and an

Japanese ADEOS satellite (design)



Key:
1. Data transmission and satellite tracking antenna
2. Solar battery panel
3. Data processing unit
4. Propulsion unit compartment
5. Communications and data transmission unit
6. Direct data transmission unit
7. Antenna
8. AVNIR radiometer
9. Electro-optical gear for meteorological observations
10. OCTS radiometer
11. Data transmission antenna

OCTS (Ocean Color and Temperature Scanner) scanning radiometer to determine temperature and color of the water's surface. Japanese scientists assume that using this gear, which has a resolution of 16 m, it will be possible to collect data on the Earth's natural resources and also for oceanographic studies (basic characteristics of the radiometers are given below). In addition to these radiometers, it is planned to accommodate electro-optical gear both of Japanese and foreign production in the satellite capable of gathering data for weather observations.

	AVNIR Radiometer	OCTS Radiometer
Weight, kg	200	180
Number of bands	4	12
Field of view, degrees (of the Earth, km)	4.6 (65)	40 (1,400)
Angle of instantaneous field of view, microradians	20	0.85
Radius of coverage, m	16	700
Data transmission rate, megabits per second	100	2.1
Power consumption, watts	250	240

According to the foreign press, programs for developing such satellites are being actively supported by the Japanese military department, which proposes to use experience of operating such satellites in the future to create military reconnaissance systems.

Articles Not Translated from ZARUBEZHNOYE VOYENNOYE OBOZRENIYE No 7, July 1989

00000000 Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89) pp 1-2

Publication Data

18010800s Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 7, Jul 89 (signed to press 17 Jul 89)

[Text] English title: FOREIGN MILITARY REVIEW

Russian title: ZARUBEZHNOYE VOYENNOYE OBOZRENIYE

Editor: V. I. Kozhemyakin

Publishing house: Izdatelstvo "Krasnaya zvezda"

Place of publication: Moscow

Date of publication: July 1989

Signed to press: 17 July 1989